Systems & Procedures

AUGUST, 1959

PUBLISHED BY THE SYSTEMS AND PROCEDURES ASSOCIATION

Systems & Procedures

Vol. 10 No. 3 — Issue No. 39

IRENE PLACE, *Editor*
University of Michigan
Ann Arbor, Mich.

WILLIAM J. BOESCH, *Managing Editor*
Parke, Davis & Company
Detroit, Mich.

DAR E. TISDALE, *Executive Editor*
Systems & Procedures Association
Detroit, Mich.

RICHARD W. REYNOLDS, *Book Review Editor*
F. W. Lafrentz & Company
New York, N. Y.

S. JOSEPH SCHNEIDER, *Worth Reading Editor*
International Business Machines Corp.
Kingston, N. Y.

* * * *

Contributing Editors

COLVER GORDON *(Chairman, SPA Publications Committee)*
Raytheon Manufacturing Co.
Waltham, Mass.

GIBBS MYERS
Kearfott Company
Little Falls, N. J.

* * * *

JACK LEMOND, *Art Consultant*
Detroit, Mich.

OFFICERS OF SPA

DAVID D. MERRIMAN, *President*
McCord Corporation, Detroit, Mich.

KEITH DELASHMUTT, *Executive Vice-President*
R. R. Donnelley & Sons, Chicago, Ill.

ROY E. CLARK, *Secretary*
Thomas J. Lipton, Inc., Hoboken, N. J.

JOHN WILLIAMSON, *Treasurer*
Toledo Edison Co., Toledo, Ohio

J. PAUL JENKINS, *Regional Vice-Pres. No. 1*
Olin Mathieson Chem., New York, N.Y.

MYRON D. HIGBEE, *Regional Vice-Pres. No. 2*
Burroughs Corp., Paoli, Penna.

NORMAN J. REAM, *Regional Vice-Pres. No. 3*
Lockheed Aircraft Co., Burbank, Calif.

DAR E. TISDALE, *Executive Secretary*

Published quarterly and copyrighted 1959 by Systems & Procedures Association
4463 Penobscot Bldg., Detroit 26, Mich.

Subscription rates: Two years, $10.00; one year $5.50; Single copies, $1.50; Foreign rates: $12.00, $6.50 and $1.75.

CONTENTS OF THIS ISSUE

The Development of a Maintenance Control Program 2
"The program caused foremen and supervisors to re-evaluate their management skills." *Charles H. Waldmann*

Some Thoughts About Methods Improvement 12
"Research is an organized method for keeping reasonably dissatisfied with what you have." *Carl A. Marquardt*

Why Forms Control Is Essential to Business 18
"Forms Control can be looked upon as a type of insurance . . ." *Ray Marien*

Installation of a 305 RAMAC 22
"Business administration must, to be successful, concentrate on fundamentals." *Robert M. Anderson*

The Information Machine 30
"The hope that the electronic computer may control the man-made communication jungle awakens tremendous enthusiasm in business and industry." *Dimetris N. Chorafas*

Book Reviews 35
Electronics in Business
Investments for Professional People
Management Principles and Practices
Opportunities in Office Management
Systems and Procedures

Worth Reading 38

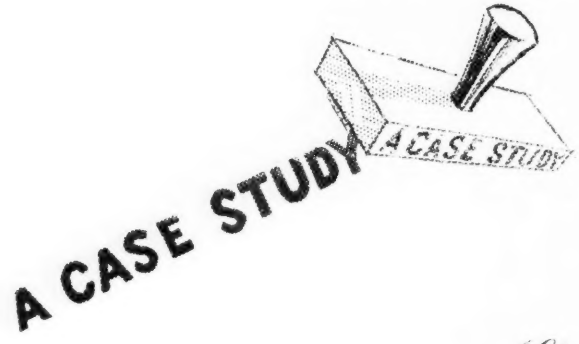
Editorial 40

Opinions expressed by authors in this magazine are not necessarily those of the Association.

Reprints of articles are available at the following prices:

Over 100	51-100	25-50	Single (if available)
$ .40 ea.	$ .45 ea.	$ .50 ea.	$ .60 ea.

The Development of a Maintenance Control Program



Charles H. Waldmann

► For some time our plant managers, maintenance engineers, supervisors, and administrative personnel in both line and staff departments had known that improvements were needed in planning and scheduling maintenance work, in more consistent methods for assigning priorities to jobs, and in more systematic estimates of manpower and material requirements. It had also been recognized generally that there was too much emergency or rush maintenance and too little preventive maintenance. Involving an annual budget in some instances of millions of dollars, the problem merited consideration.

The Problem

On one side of the problem was our top management, concerned with increasing maintenance costs and the apparent lack of adequate budget justification for them. On the other side, the maintenance engineers had their specific problems. Each plant had its own maintenance system. An over-all standard program or method did not exist which might prove to management the effectiveness of any one system. Worse, the pressure of keeping up with heavy workloads left little time for the engineers to develop tangible data for management which could present the *pros* and *cons* of the situation. The Organization and Procedures Department was, therefore, authorized to make a preliminary survey of the maintenance function and to present recommendations for the development and installation of a full-scale maintenance control program.

Charles H. Waldmann, past president of the Manhattan Chapter, SPA, is Senior Systems Engineer, Domestic and International Operations, American Smelting and Refining Company, New York City. He was formerly with the Port of New York Authority, the General Electric Company, and the Western Electric Company where he specialized in organization studies, management analysis, maintenance control programs, and systems and procedures. This article describes a "case study" made by Mr. Waldmann before he joined ASARCO.

The Preliminary Survey

The preliminary survey was started immediately. Extensive data were collected at the major plants and lesser detail was gathered at the smaller operations. Data were based on physical inspections and upon a series of pointed questions on maintenance practices, to which blunt answers were received. Everywhere, however, the analysts found a desire to cooperate with the survey and a willingness to participate in the development of better systems. In other words, the study was a "team" operation with the Organization and Procedure Department as the principal staff unit. The Organization and Procedure Department worked with the line departments on all phases except the ultimate development of standards. These were handled by the industrial engineers.

The findings showed that, as a whole, maintenance work was not planned and scheduled; the "squeaky wheel" often got the grease. There was no system for assigning priorities to jobs; manpower and material requirements were not estimated on a planned work program but rather on the basis of recurring crises, emergencies, and pressures.

Other specific findings were as follows: Approximately 19 different work requests and work order forms were in existence. Up to seven types of rush and emergency priorities were in effect. Work was not performed in order of importance. Cost records were inadequate. There was no advance planning for daily, weekly, or monthly workloads. Preventive maintenance was somewhat impromptu and incomplete. A backlog record of work by craft, or amount and type of materials required to clear up the backlog, was not being maintained. There were few controls on the amount of new maintenance work to be undertaken, other than on the availability of staff.

The Recommendations

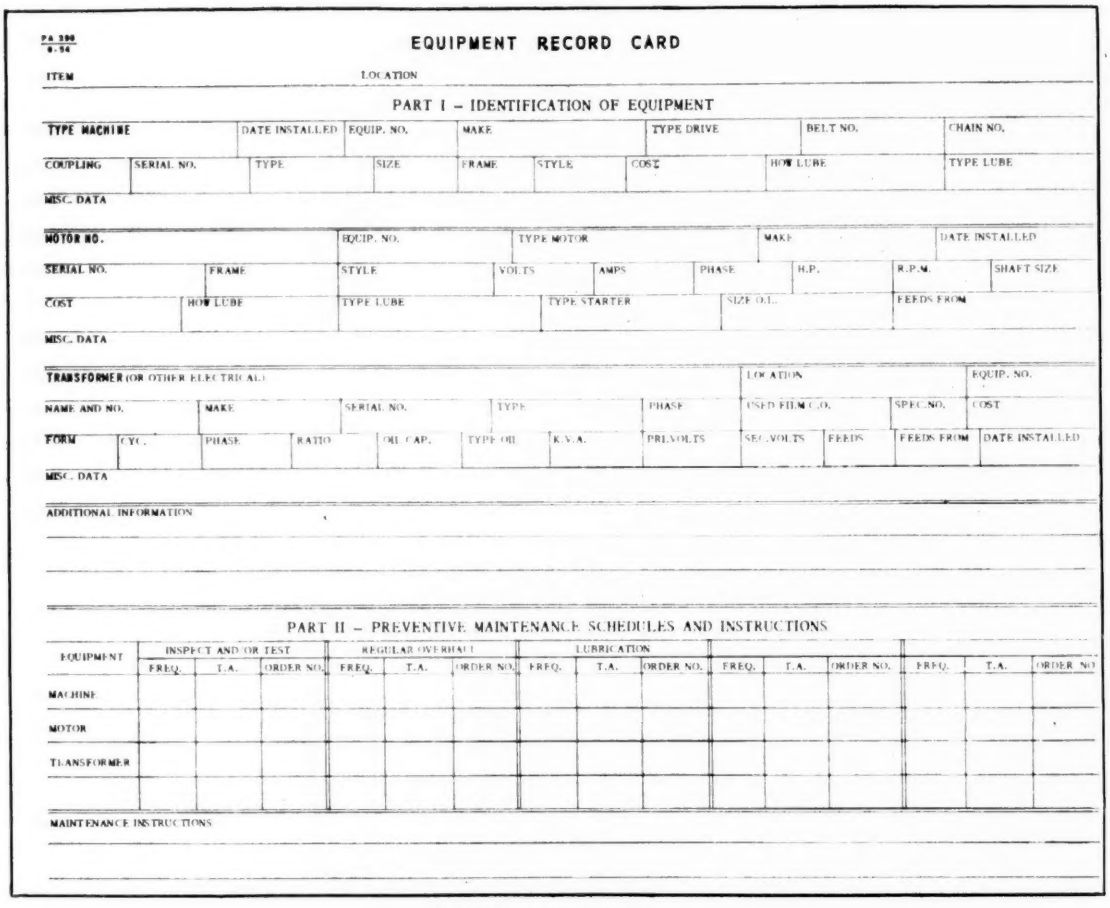
A report was prepared for management on the basis of the findings. It recommended the development and installation of a complete maintenance control program of six major phases:

1. Develop and install administrative controls such as a work order system and the listing of routine jobs
2. Develop and install procedures for controlling and scheduling manpower, equipment, and materials
3. Develop a system of recordkeeping for each plant for filing, compiling, and tabulating information to be used in analyzing and improving maintenance as it relates to cost control, preventive maintenance, manpower and equipment requirements, budget detail, and methods and techniques
4. Develop standards
5. Develop a system of materials control
6. Develop a system of reports to the various levels of management to portray the status of the maintenance activity

A Maintenance Control Program

A maintenance control program establishes a systematic method for effectively planning, organizing, and utilizing men, materials, and equipment to keep the plants in good operating condition as economically as possible at the plants at all times and under all conditions. There were two types of maintenance:

1. "Happening" or breakdown maintenance takes care of failures in machinery and equipment during a scheduled production period. Then only the repairs necessary to put the equipment back into production are



PA 300
6-54

EQUIPMENT RECORD CARD

ITEM LOCATION

PART I – IDENTIFICATION OF EQUIPMENT

TYPE MACHINE	DATE INSTALLED	EQUIP. NO.	MAKE	TYPE DRIVE	BELT NO.	CHAIN NO.
COUPLING	SERIAL NO.	TYPE	SIZE	FRAME	STYLE	COST	HOW LUBE	TYPE LUBE
MISC. DATA								

MOTOR NO.	EQUIP. NO.	TYPE MOTOR	MAKE	DATE INSTALLED
SERIAL NO.	FRAME	STYLE	VOLTS	AMPS	PHASE	H.P.	R.P.M.	SHAFT SIZE
COST	HOW LUBE	TYPE LUBE	TYPE STARTER	SIZE O.L.	FEEDS FROM
MISC. DATA					

TRANSFORMER (OR OTHER ELECTRICAL)						LOCATION			EQUIP. NO.
NAME AND NO.	MAKE	SERIAL NO.	TYPE	PHASE	USED FROM C.O.	SPEC. NO.	COST
FORM	CYC.	PHASE	RATIO	OIL CAP.	TYPE OIL	K.V.A.	PRI. VOLTS	SEC. VOLTS	FEEDS	FEEDS FROM	DATE INSTALLED
MISC. DATA											

ADDITIONAL INFORMATION

PART II – PREVENTIVE MAINTENANCE SCHEDULES AND INSTRUCTIONS

EQUIPMENT	INSPECT AND OR TEST			REGULAR OVERHAUL			LUBRICATION								
	FREQ.	T.A.	ORDER NO.	FREQ.	T.A.	ORDER NO.	FREQ.	T.A.	ORDER NO.	FREQ.	T.A.	ORDER NO.	FREQ.	T.A.	ORDER NO.
MACHINE															
MOTOR															
TRANSFORMER															

MAINTENANCE INSTRUCTIONS

ILLUSTRATION No. 1

made. This form of maintenance is expensive and precludes maximum production.

2. Preventive maintenance is a sound, logical, tested system, planned to obtain maximum efficiency and production with existing equipment. It aims to prevent breakdowns and shutdowns by sytematically providing for inspection of equipment so that adjustments and repairs are scheduled and made before failures occur.

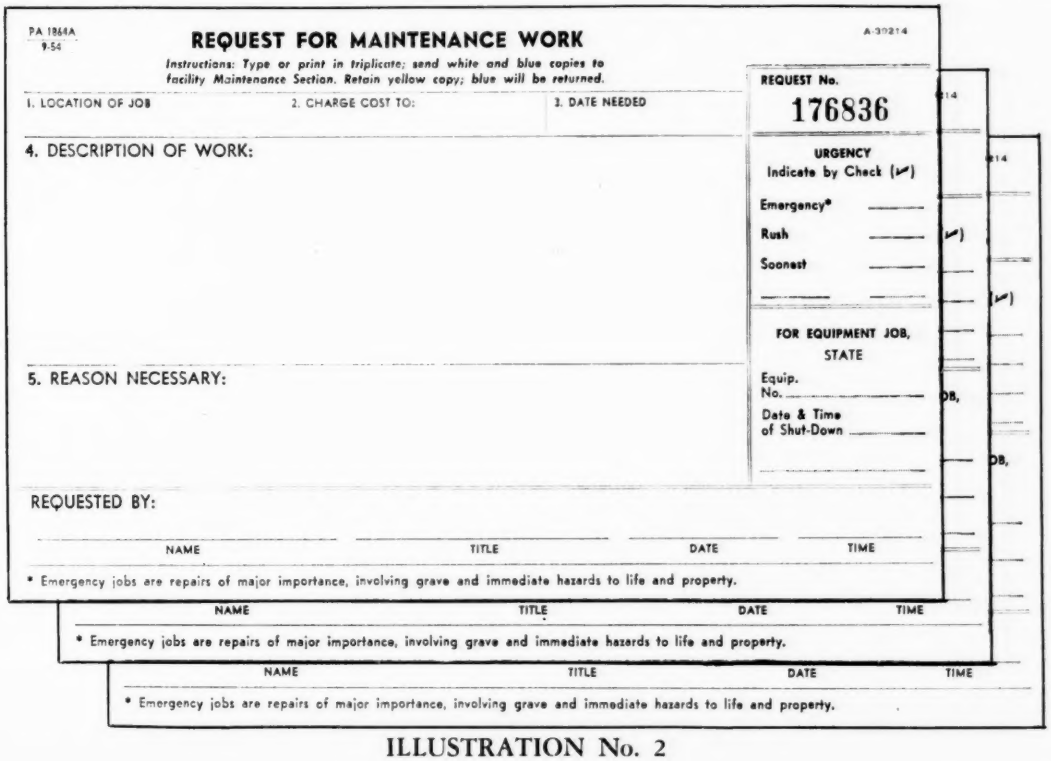
As a first step in developing a satisfactory maintenance program, successful ones were investigated in other companies and in other areas. The procedures, forms, reports, techniques, and reactions of the men to each were studied by visiting successful installations; talking to maintenance engineers, foremen, and maintenance men; and by attending maintenance and engineering conferences and technical sessions.

The survey team then evaluated the acquired information in the light of its own requirements and used what it could. Forms, reports, and procedures were designed as follows: (1) Equipment Record Cards, (2) Routine Job Programs, (3) Maintenance Work Requests, (4) Work Orders, (5) Work Schedules, and (6) Reports. Since these forms played a major part in the program which was finally instituted, a brief review of the use and purpose of each is given:

1. *Equipment Record Cards.* The record cards provided for the identification of each item of equipment and for each major structural component: a summary record card showed the location of each item, nameplate data, and other identifying characteristic; the preventive maintenance schedule; and the repair history. In order to establish these record cards, a complete physical inventory was taken of all equipment for which the maintenance group had responsibility. Each such unit was assigned an identification number to facilitate location and to enable foremen and workmen readily to identify an item for preventive maintenance purposes. Provisions were made for the recording of breakdown data from the work order to the back of the equipment record card. (See Illustration No. 1)

2. *Routine Job Programs.* Routine jobs consist of maintenance work that is done on a regular periodic basis: daily, weekly, monthly, or yearly. They cover routine machine adjustments and repetitive tasks such as lubrication and cleaning. The study showed that records of these routines had previously not been maintained; they were kept in the foremen's head. All such routines were, therefore, documented along with related data such as hours per team, manhours per year, crafts, season, weather, frequency, next due date, and routine job number. Work orders were issued to eliminate the necessity of repeatedly issuing individual work orders for jobs that could be prepared in advance. The work orders were then filed, ready for the regular due date, and were incorporated into work schedules through an orderly pre-planned procedure.

3. *Maintenance Work Requests.* Requests for maintenance work (a 3-part form, see Illustration No. 2) are used to notify the Maintenance Department of work to be done. They contain a description of the work and indicate the urgency of the request. After the foremen and



PA 1864A
9-54

REQUEST FOR MAINTENANCE WORK

Instructions: Type or print in triplicate; send white and blue copies to facility Maintenance Section. Retain yellow copy; blue will be returned.

A-30214

1. LOCATION OF JOB | 2. CHARGE COST TO: | 3. DATE NEEDED

REQUEST No. 176836

4. DESCRIPTION OF WORK:

URGENCY
Indicate by Check (✓)
Emergency* ____
Rush ____
Soonest ____

FOR EQUIPMENT JOB, STATE
Equip. No. ____
Date & Time of Shut-Down ____

5. REASON NECESSARY:

REQUESTED BY:

NAME | TITLE | DATE | TIME

* Emergency jobs are repairs of major importance, involving grave and immediate hazards to life and property.

NAME | TITLE | DATE | TIME

* Emergency jobs are repairs of major importance, involving grave and immediate hazards to life and property.

NAME | TITLE | DATE | TIME

* Emergency jobs are repairs of major importance, involving grave and immediate hazards to life and property.

ILLUSTRATION No. 2

maintenance supervisors use the requests to "cost" the jobs, they serve as a basis for preparing work orders which instruct the workmen about what is to be done. At this stage the foremen also determine the priority of the jobs.

The back of the original copy of the form is used to evaluate the request and is sent to the Maintenance Department with the second copy. The third copy is retained by the originator for follow-up. The Maintenance Department returns the second copy to the originator after inserting the date the work is to be done.

4. *Work Orders.* Work orders are prepared on the basis of a foreman's prior estimate of the job (as described above). There are three types of work orders: (1) Rush and emergency jobs (pink form), (2) Non-rush jobs (yellow form), and (3) Routine jobs (white form, see Illustration No. 3). These work orders, prepared by a maintenance scheduler or his clerk, provide information to the leadman about what is to be done, where, by whom, material and equipment needed, and the date. A completed work order provides data for determining cost, material usage, manpower and equipment usage, validity of foremen's estimates, factors causing delay, and unusual circumstances.

5. *Work Schedules.* Working from vacation and "dayoff" schedules, the scheduler constructs an advance schedule of manhours available by craft groups. A reserve of manhours is set aside for "Rush" work. The estimate is determined by experience and is naturally subject to revision as more accurate recordkeeping helps the scheduler to make a better forecast. Thus, "Rush" jobs are accommodated in the over-all work schedule without sacrificing regularly scheduled work. The schedule is set up for weeks in advance, until the backlog of work has been recorded.

Each day the foremen review the visible index record of the work load scheduled for the week, select jobs to be done the following day, and prepare a simple work

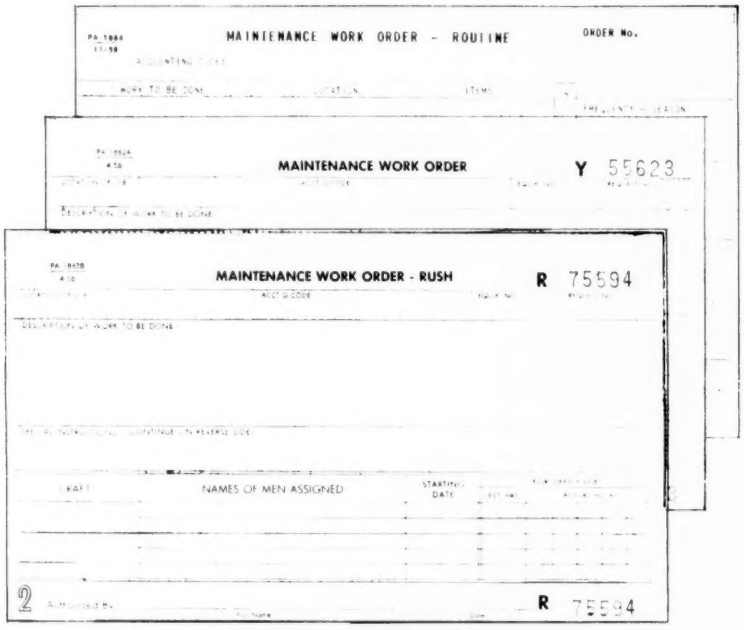


ILLUSTRATION No. 3

assignment sheet. After reviewing the assignment sheets for discrepancies, the scheduler releases them to a typist who prepares the next day's work schedule.

Daily work schedules must be flexible so that in the event of emergencies or inclement weather, changes can be made quickly and in an orderly manner. The foremen prepare, in advance, rainy-day schedules which can be substituted for regular schedules on short notice.

Certain crafts are often underscheduled in anticipation of "Rush" work. If it does not materialize, Non-Rush work is scheduled on a fill-in basis. Changes, additions, and deletions are made in red pencil on the original copy of the schedule. At the end of the work day, reasons for the changes are reported along with information about the end-of-shift status of the work orders.

Four copies of the daily schedule are prepared for each craft. The second copy is posted on the bulletin board so that leadmen and maintenance crews can see what is scheduled for the next day and what tools, equipment, and material will be required so that they can prepare in advance. The third copy is for foremen and gives them complete detail about the location of their men and what they are doing. It facilitates inspections and checks on progress. A fourth copy is for the maintenance supervisor as the schedule is used to help evaluate the planning and organizational skill of foremen. The original is sent to the plant manager one day later with all changes and additions shown in red pencil. This facilitates the discussion of question or problem areas with the maintenance supervisor.

6. *Reports.* The following "reports" and "statistics" are prepared: (1) A corrected copy of a Daily Schedule of Maintenance Work to the plant manager gives him a complete picture of maintenance activity and enables him to evaluate its effectiveness and that of the maintenance supervisor. (2) The Maintenance Work Load for Future Weeks (See Illustration No. 4) shows the backlog of the various crafts by type of work (Rush, Non-Rush and Routine) and estimates the number of weeks required to complete it. This information speeds decision making, permits advance planning for adjusting manpower requirements, controls rush work, and cuts down excessive backlog. (3) Maintenance Program Statistics are used for complete maintenance budget justifications and enable management logically to determine and control expenditures. (4) Maintenance Data are available for a variety of special reports which can be prepared on demand such as cost breakdowns, estimated versus actual time to do work, and vehicle usage. Evaluations can then be made at almost any time about the effectiveness of the program, equipment replacements needs, reduction in "down-time," need for better standards, and improvement of maintenance techniques.

Installing the System

After the development of the basic system, management picked the most complicated plant—maintenance-wise—for a test installation. The plant had over two hundred maintenance personnel representing every conceivable craft—electricians, plumbers, painters, structural mechanics, laborers, gardeners, carpenters, and welders—whose work ranged from replacing furnace brick to lubricating equipment.

Desk space was provided in the maintenance shop and the survey team virtually lived at the plant often for 3-shift operations, installing the work-order system. The listing of routine jobs was reviewed; experiments were made with filing equipment; and foremen, staff people, and

PA 1953
7-55

MAINTENANCE WORK-LOAD ' 'EDULED FOR FUTURE WEEKS

FACILI

DATE PREPARED / /5

CRAFT	CRAFT GROUP	WEEK BEGINNING												
		/	/	/	/	/	/	/	/	/	/	/	/	/
	TOTAL PAYROLL HOURS													
	SCHEDULED ABSENCES													
	RESERVED - UNSCHEDULED ABSENCES													
	RESERVED - RUSH JOBS													
	TOTAL RESERVE													
	NET AVAILABLE FOR SCHEDULING													
	SCHEDULED - ROUTINE JOBS													
	SCHEDULED - NON-RUSH WORK													
	TOTAL SCHEDULED													
	BALANCE													
	TOTAL PAYROLL HOURS													
	SCHEDULED ABSENCES													
	RESERVED - UNSCHEDULED ABSENCES													
	RESERVED - RUSH JOBS													
	TOTAL RESERVE													
	NET AVAILABLE FOR SCHEDULING													
	SCHEDULED - ROUTINE JOBS													
	SCHEDULED - NON-RUSH WORK													
	TOTAL SCHEDULED													
	BALANCE													
	TOTAL PAYROLL HOURS													
	SCHEDULED ABSENCES													
	RESERVED - UNSCHEDULED ABSENCES													
	RESERVED - RUSH JOBS													
	TOTAL RESERVE													
	NET AVAILABLE FOR SCHEDULING													
	SCHEDULED - ROUTINE JOBS													
	SCHEDULED - NON-RUSH WORK													
	TOTAL SCHEDULED													
	BALANCE													
	TOTAL PAYROLL HOURS													
	SCHEDULED ABSENCES													
	RESERVED - UNSCHEDULED ABSENCES													
	RESERVED - RUSH JOBS													
	TOTAL RESERVE													
	NET AVAILABLE FOR SCHEDULING													
	SCHEDULED - ROUTINE JOBS													
	SCHEDULED - NON-RUSH WORK													
	TOTAL SCHEDULED													
	BALANCE													

ILLUSTRATION No. 4

maintenance schedulers were trained. Procedures were revised. The forms, schedules, and reports were changed to expedite processing to meet new requirements and to overcome unforeseen problems.

As in any new program, the plan could only succeed to the extent that people could adjust their work habits, customs, and traditions to the new situation. It was necessary for some of them to acquire new skills. During this period of transition a certain reluctance was often found to change from the old way of doing things. Fortunately, the more progressive foremen came to the front at this point. They used the new program and improved the performance of their groups. Their success sparked a new co-ordinated effort which in the end firmly established the effectiveness of the test installation. The learning process was a two-way street in that the maintenance group as well as the survey team had learned some lessons:

1. Management must be sold in advance on the merit of a program and must back it solidly during the critical installation stages if the benefits of a realistic program are to be achieved.

2. A strong and formal training program prior to installation is desirable in order to speed up the transition period.

3. The potential of the man who is "low" on the organization chart must never be underestimated. His reaction to a new procedure can make or break it.

On the basis of the practical experience acquired during the test installation, the following developments took place: (1) A series of process charts was prepared outlining the basic program. (2) A brochure entitled *Forms Guide to Work Order Scheduling* was prepared. It provided detailed information about the use of each form designed for the system. (3) Temporary operating instructions were written clearly and completely to define policy and procedures to be followed. (4) A training program for foremen and maintenance schedulers was developed to outline the indoctrination procedures.

With this basic training material, the team was now ready to conduct indoctrination sessions with other groups on the theory, operation, objectives, and potential benefits of the program. The first group to receive the indoctrination was top management—the executive director and his staff, the department heads and their staffs. Three-day seminar-type indoctrination sessions were next conducted for the maintenance supervisors and schedulers at each plant. Two days were spent in theory and application and one day in actual review of the working installation. This gave them a chance to participate in selling the program at their level.

Indoctrination sessions were next conducted for the maintenance men. These were 2-hour sessions and outlined the benefits of the program explaining the responsibilities of maintenance men in the operation of the system.

The survey team worked with plant maintenance and management on a continuing basis to help with the listing of routine jobs, installing the system, training the personnel, and ironing out any "bugs" that appeared. It might be of interest to observe that outside of the survey team no special personnel was needed to install or administer the program although some overtime was required during the initial stages.

While the operation of the Maintenance Control Program is not without cost, much of it is merely a transfer of previously existing clerical costs. Any additional cost which might develop in operating the Program will amount to only a small percentage of the annual savings resulting from more efficient maintenance work. (Savings were estimated conservatively at 10 per cent of the total maintenance labor costs).

Additional Savings in Improved Management Effectiveness

Departments and plants benefited throughout because of the development of means of relating organizational structures and numbers and types of personnel to the amount and type of maintenance work done. Improved manpower and equipment utilization also resulted from these techniques, particularly the development of better managers responsible for maintenance work at the various levels. The following specific benefits were a further direct result of the installation of the Maintenance Control Program:

1. Clarification of organizational relationships and maintenance functions resulting in a lessening of personality and jurisdictional clashes.

2. Provision of standards which, with the routinizing of various types of maintenance workloads, have made it possible for a plant to plan its day-to-day work, measure its effectiveness, and program its future workloads.

3. Provision of data which can now be used for (a) cost reduction through better work methods and techniques, (b) planning more effectively for the better

utilization of new equipment, materials, and proper size and flexibility of work forces, and (c) work scheduling which provides for a proper and steady flow of work.

4. The establishment of standards by which to evaluate staff performance as it relates to maintenance.

5. The creation of an awareness in many of the foremen and supervisors that in this era of technological advancement, tight labor market, and sensitive labor relationships, much more than technical qualifications are required to direct the activities of a maintenance group—large or small.

Further aspects of the Program, not yet completely installed, however, at this writing are: A Maintenance Activity Performance Profile for the evaluation of each plant's maintenance work. It is believed this will be a possible supervisory incentive since it will recognize the contribution of each to maintenance activity. This would help to establish effective control over plant management and supervisory performance and would foster a competitive spirit among plants. One key aspect to such a profile is the ratio of routine to non-routine work (a good standard is 70 per cent routine and 30 per cent non-routine). The greater the number of justified routines, the better the preventive maintenance program which permits more effective planning, scheduling, and utilization of men, materials, and equipment. Suggested performance profiles for the different management levels can be as follows:

Manager. A manager's performance would be judged acceptable if: (1) The ratio of routines to non-routines is at least 70 to 30 (although experience may prove that this ratio should be varied for particular plants). There is evidence, however, that the justified routines continue to increase in relation to the non-routines. (2) The rush work is being reduced and the categories of "rush" are legitimate and not generated by whim, personal prestige, or just plain lack of planning. (3) There are actual dollar savings resulting from the review and analysis of routines and new techniques are being developed. (4) Maintenance manpower is in balance with maintenance workload.

Maintenance Supervisor and Foreman. Maintenance supervisors could be evaluated the same as managers with the following important additions: There should be evidence that (1) The schedulers' functions are being properly performed as they relate to advance scheduling; that daily schedules, work orders, and equipment report cards are up to date and properly posted; that an up-to-date file is being maintained; and that requested statistics are readily available; (2) Time has been devoted to developing the foremen as follows: Regular foremen's meetings are being held at which problems are discussed and resolved; written recommendations and proposals resulting from these discussions are being made to the next level of management; the productive output is meeting maximum requirements, and if not, solutions are being developed.

Foreman. Similarly, foremen would be evaluated on their administrative ability as well as on technical skills. (1) There is evidence that systematic action is being taken on cost reduction, and on the development and testing of new work techniques and methods. (2) Workloads and types of work are being reviewed and analyzed to determine whether standards are being met. (3) Budget justifications for manpower, equipment, and material are being prepared on the basis of statistics available from the Maintenance Control Program. (4) Program requirements are

met because schedules are made in advance, changes in the schedules are at a minimum, work orders are carried into the field by the workmen and are properly processed, required reports are prepared on time, and adequate information is presented to the plant manager on which decisions can be made. (5) Long-range planning of the maintenance activity is taking place. (6) Improvement objectives for foremen, maintenance teams, or craft groups exist in writing.

Effect of Program on Maintenance Personnel

As a result of this Program, first echelon supervisors from leadmen to maintenance supervisors have a new insight and a keener awareness of their responsibilities and of the part they play on the management team. They recognize more clearly that savings from the millions of dollars spent in maintenance costs can be realized through the efforts of informed and progressive maintenance leadership. They feel, therefore, that they have been taken out of the category of "laboring foremen and production pushers." As they gain experience in these areas, they recognize that they themselves must develop into "managers"—men who can be relied upon to supply factual information to management, to develop new techniques and methods which will enable them to exercise better control, to enhance decision-making, and to institute improved operating procedures. They realize that all of this will assure a smoother functioning plant.

This program caused foremen and supervisors to re-evaluate their management skills. As a result, a steady "grass-root" type of interest has spread among them in supervisory skills as they relate to communications, to the establishment of discipline, to production, and to the better selection and training of men. The workmen, both skilled and unskilled, have in turn requested training sessions about the Program and about the management philosophy behind it. (A discussion of the Maintenance Control Program is now a definite part of all first-time training programs for supervisors and maintenance foremen). This spreading of interest of the maintenance force in supervisory skills should be encouraged because it indicates a revitalization of interest and personal progress.

The maintenance supervisory staff has become more conscious of work measurement and the analysis team found definite trends toward setting up empirical standards. Weekly meetings with the foremen are therefore now being held to discuss a predetermined group of routine work orders so as to evaluate frequencies, time allowances, work methods, and economic justifications. At these meetings, maintenance supervisors screen and evaluate routine maintenance work orders and classify the savings as to revision of frequencies or time allowances, revision of methods, or revision due to physical factors.

The writer believes that all plant maintenance forces should be encouraged to analyze, evaluate, and experiment with the Program developed to date. With their broad knowledge and experience at the plants, they are in a position to develop new techniques and methods which will materially cut costs and improve the maintenance operation.

The reactions of management and maintenance personnel to the Program were excellent in most cases. Labor and material costs were cut, and a spirit of understanding and loyalty prevails. There is practically no limit to the improvements, better maintenance practices, and costs reductions that can be realized. **s/p/a**

Some Thoughts About Methods Improvement

Observe. Think. Decide. Act.

C. A. Marquardt

▶ Mr. George J. Mecherle, founder of State Farm Mutual, said a number of years ago: "We have the finest insurance organization in the world; it is too bad we have had to place human beings in it."

No business is successful by chance. It requires planning and teamwork to make it that way. As companies grow, their managements look forward to a state of business where competition is keen. To survive they must be among the best — preferably, THE best. They look forward to a period of continuing growth.

As responsible members of the management profession, methods and procedures analysts are expected to help achieve effective management and to keep it alive and alert. Their services have become indispensable to the coordinated administration of all business activities. You have heard and will continue to hear more about the importance that methods and procedures work play in a company. There has been and still is an excellent opportunity for it to perform a constructive service for all levels of management by pointing out where existing methods and procedures of all kinds can be modernized to give management what it wants and needs.

Cooperation among staff and line departments helps us find efficiency and economy in operations and methods. Since we are all engaged in highly competitive businesses wherein the penalty for inefficient methods and procedures is ultimate failure, they must be kept under constant observation. They must be tried and retried. And, ultimate responsibility for

Carl A. Marquardt is Vice-President of Planning and Research, State Farm Mutual Automobile Insurance Company. Mr. Marquardt has been with his company since 1934. He is a graduate of the Illinois State Normal University and a member, in his Company, of the Electronics, Operating, and Policy Forms Committees.

improvement does not rest upon any one individual or department. It rests with an entire organization. No one should be exempt.

The work of methods and procedures improvement is dynamic. "Status quo" is only an indirect way of saying *stagnant.* The goal is improvement. That is why those who perform it are called methods and procedures analysts. They analyze methods and procedures for improvement. This is their job. And, their ability to improve must grow with the needs of the companies served. In meeting past problems, some refer to the words of Oliver Sheldon in *The Philosophy of Management:*

> "We all like our own way of doing things, and this is normally not the best way. We have to learn to do things in the best known way, to rely upon research in which we ourselves may not have shared, to accept what is more efficient in preference to what best pleases us or falls in with our habits."

Charles Kettering's words are also appropriate here: "Research is an organized method for keeping reasonably dissatisfied with what you have."

Work Simplification

It is probably the understatement of the year to say that there is need for work simplification in offices today. Work simplification in the office has not kept pace with the ever-increasing number of office workers. But let us consider briefly what we mean by work simplification in the office. It does not necessarily mean getting out of work. It means that the unnecessary parts of any job should be eliminated and that the remaining ones should be combined, rearranged, and simplified. In other words, the parts which remain should be arranged and performed in the simplest way possible. Work simplification, we have long been told, is the application of common sense to eliminate waste of any kind; waste of time, energy, material, equipment — even waste of imagination. It has been sometimes described as a methodical, scientific analysis of men, materials, methods, space, and equipment involved in the performance of certain operations. It is, however, nothing more than a common sense method for the elimination of waste, particularly of the waste of human energy and human effort. It simply aims to take the headaches and backaches out of our daily work. Work simplification is, of course, also a way of thinking; a philosophy, a way of life. The elimination of waste implies getting direct results, and results come from better methods only when they are enthusiastically employed by the people who use them. You can have the best methods and the best equipment, but if the people using them do not agree with you and use them as they should, you will be right back were you started from, maybe even worse.

Let us say further that a concept of work simplification is TO IMPROVE EFFICIENCY AND REDUCE EXPENSES. Do you, a methods and procedures analyst, like this idea; the connotation? Yet it is something we can understand. It is a connotation inherent in any aspect of work, paperwork, or job simplification. It identifies more than a title of a program — it identifies a challenge. We at State Farm are interested in MORE than work simplification in our offices; we are interested in improving our overall efficiency and our service to the public. Work simplification is needed today more than ever. Why?

Up until the past decade, mechanization of the office has been progressing slowly. Now, of course, with electronic data

processing equipment and ideas, the right kind of progress has speeded up and work simplification makes it easier to apply modern electronic systems. Everyone agrees that careful planning is necessary before an electronic system can be advantageously introduced into an office. A first stage in such planing is generally a rough programming, in sequence, which lays out the problem. A second stage involves a "rough optimizing" in which programs are rearranged in such a sequence as to make successive programs available as fast as possible. A third stage is an "elegant optimizing." This is a refinement of rough optimizing so that several programs can be combined to eliminate unavoidable idle time — even when that unavoidable idle time may be no more than one-half of the revolution time of the drum, or about 2.4 milliseconds.

Work simplification — planning and programming — is necessary today for the more sophisticated mechanization of clerical jobs. Too frequently, however, it does not go beyond the rough programming stage. Work simplification does not materialize to the extent it should, because the work somehow gets done without it. Too often we think work simplification is being performed, but it is not. We have become too accustomed to living with the job as it is.

Some time ago I heard a speaker describe a survey which had been made to see how much time fathers spend with their young sons. I mean how much time they really spend with their sons, where they give undivided attention to a boy. The survey showed that the average father really spends seven minutes per week with his son. Do you believe this? At first I did not; but stop to think about it. One becomes accustomed to living with his children — just as we become accustomed to living with the way work is being done in our office. Somehow it takes an unusual situation to cause us to give it our "undivided attention."

One of the most valuable aims of education, I think, is to teach one how to do what he has to, when he has to, whether he likes it or not. It is the first lesson one should learn. But however early a man's training begins, it is probably the last lesson that he learns thoroughly.

A Four-Step Approach

Our approach to a problem at State Farm finds us armed with the following four-step approach: Observe, Think, Decide, and Act.

Observe. To see is not enough. You must know what is being done or nothing can be accomplished. Assume nothing; assumption is a great pitfall and leads to erroneous conclusions. Get the facts. When you have them, check them. Write them down, all of them. Try different approaches. Ask lots of questions. Try to see the whole picture, not just individual trees. Final conclusions are limited in direct relation to the accuracy of observations.

Think. It's the hardest thing anyone does but success demands it. Analyze problems. Re-read your observations in light of the analysis. Is there more than one problem involved? List each one. Do you have answers to *Who, Where, When, Why,* and *What?* Seek advice. Your ego will suffer more from failure than it will from accepting assistance. Don't learn this lesson the hard way!

Decide. You are judged by your decisions. If you cannot come to a conclusion then you have wasted your time. Snap decisions leave too much to chance. Review all the work you have done up to the point of making the decisions. When

you can admit to yourself without reservation or rationalization that you have done the best you can — *decide.* Since your decision is your "best way," be sure that it is.

Act. Have the courage of your convictions. Think in a positive manner. When you have reached the point of action, the time for doubt is past. You must sell yourself and your decisions. Everyone resists changes and you are changing things. Try not to be discouraged by complacency. It usually only indicates a need for more selling. But, do not "throw your weight around." Somebody may "cut" you down to size. Take your time. Be a good teacher. No one likes to be pushed. Be available when questions come up. Install the "new plan" personally whenever possible. Check frequently to be sure that instructions are being followed. Don't let the "new plan" become obsolete. Continue to look for "the best way."

Communication

Methods and procedures analysts are charged by their companies with the responsibility of finding "the best way" and then with communicating that knowledge so that it is certain and understandable. All types of communication devices are used. Memoranda, letters, meetings and conferences, telephone calls, work process manuals, personal instruction, and procedural audits are all used to this end. However, the written word is probably most important. It demands that the writer be selective and precise so as the exclude ambiguity. He must, therefore, sometimes write, rewrite, delete, add to, and even start over again. And why not? What good is it to find "the best way" if one cannot translate it for practical application?

Since the complexities of lines of communication in modern business preclude the use of the spoken word as the *source* of a procedure, oral instructions must be quickly followed by written ones to insure uniformity and certainty. Human memory is not dependable and in the instance of a new system is usually distorted by past habits and prejudices.

A Procedures Manual

When instructions are written and distributed in a manual, employees cannot evade the responsibility of knowing what they contain. The office manager who does not use manuals is faced with having employees *remember* what was said or of misunderstanding the instructions which were given. If carefully prepared manuals of procedures are given to new employees at the time of employment, and if new workers are told that they are expected to read the manual and will be held responsible for a knowledge of its contents, troublesome problems resulting from forgetting and misunderstanding can be avoided.

The preparation of a manual is an excellent basis for the continued development and standardization of company, departmental, and individual procedures. Many overlapping functions and wasteful duplications are thus revealed. Departmental procedures, as well as relationships between divisions and sections, which may have resulted from other than systematic planning are uncovered. The manual serves as an excellent basis for eliminating inconsistencies and is a means of reducing wastes which result from them. Its preparation generally forces the determination of the easiest, surest, and the most productive methods. Its very nature helps to assure that they will become the habitual methods.

By telling each individual to whom and for what he is responsible, manuals define responsibilities and prevent errors. Their

preparation brings to light error-breeding situations that can be corrected. The effect is to decrease misunderstandings and mistakes, and to move work along smoothly and more rapidly. Change and growth sometimes bring about overlapping of departmental functions, while at other times they create gaps between them. The attention necessarily given to definitions of duties and responsibilities when preparing a manual leads not only to a better and more accurate dovetailing of departmental responsibilities but to their more complete coordination.

If the initial preparation and later revision of a manual is made a cooperative effort, with the chief burden for its effectiveness placed upon those responsible for getting out the work, it becomes a powerful incentive for constructive thinking. Every business needs men who can think originally and progressively. Such men, to a certain degree however, have to be made to order. Their discovery and development is in itself an important job which is furthered by systematic efforts to establish efficient and coordinated methods and procedures.

At State Farm we in the Planning and Research Department start the study of a problem by observing what was done prior to the establishment of our Department. We then record this carefully. This procedure accomplishes four things: 1) It allows us to detect lack of uniformity; 2) It allows us to detect poor procedure; 3) It shows up lack of good supervision; and 4) It gives us an opportunity to chart our progress.

A United Effort

Our present *Work Process Manual* has come into being, in evolutionary stages as we have pursued uniformity — in writing. The preface of our *Work Process Manual* reads as follows:

"The purpose of this *Work Process Manual* is to provide the basis for the general processing of work and the procedures to be followed in the integrated divisions that are charged with the responsibility of handling the Company's office dealings with and concerning its policyholders.

"It is the Company's desire to standardize the processes and procedures so as to provide a means of control over the quantity and quality of the work and time consumed in the accomplishment. Uniformity throughout the various divisions is a natural objective. It is recognized that there are and will be exceptions based on certain requirements of the different states, and these exceptions are noted to provide a thorough understanding of the entire Company's operations.

"The expectation of uniformity in the various divisions is not with the thought of establishing inflexibility and complete rigidity of operations. No person should become so committed to a course of action that all ideas of change or improvement are excluded. The Company welcomes ideas and suggestions in an effort to improve its operation procedures and fully recognizes that such participation evidences interest and will produce improved practices and uniformity of methods."

Those of us who prepare this manual constantly criticize, review, and rewrite it in our search for "the better way." It must always be "obsolete" so that it will never become so to those who use it. Our *Work Process Manual* has never had any "sacred ground" nor "infallible authors." We have no ivory towers in our Department which closet bright young men, nor do we entertain a force of crystal-ball gazers.

The one-man or one-group methods and procedures improvement show may survive through a company's infancy, but it cannot survive among the leviathans of the insurance industry. Ours is a very complex and highly competitive business that demands the best efforts of many hands and *all* minds. Thus, we in the Planning and Research Department seek ideas for improvement from everyone and *particularly* from those engaged in processing the work.

Information which eventually becomes part of our *Manual* flows through three channels: our own department, procedure committees, or our suggestion system. We have seven specific procedure committees and one general procedure committee. Each specific committee is concerned with matters which relate directly to its unit of our operating divisions. If an idea withstands the scrutiny of this group, it is then passed to the general committee, with recommendations. The general committee reviews the idea for application within the Company as a whole. If it gives approval, it becomes the responsibility of our department to put it in writing and to see that it is properly distributed throughout the Company.

Our employee suggestion system follows a similar pattern. It too is composed of sub-committees and a general committee. It encompasses practically everything that involves the company. True, we may pay for some suggestions which eventually prove to be worthless, and we may reject some suggestions which should be used. The majority, though, are handled correctly and benefit is, we think, derived. Human nature being what it is, we are sometimes confronted with the problem of having the one who made the suggestion anticipate that no matter what we do with it — accept it or reject it — he won't like it. The last time this happened, one of our committee members commented that it reminded him of an aunt who one Christmas gave her husband two ties as a present. When he came down to breakfast the next morning, wearing one of them, she said, "I see you do not like the other tie."

Conclusion

It should be observed, in conclusion, that matters which may be quite clear to a trained or experienced person are not necessarily so to new employees within an organization. Furthermore, fitness as an executive does not necessarily qualify one to teach. As a result, explanations of methods of doing work by executives are not always clear. The preparation and use of manuals helps to overcome such difficulties.

The proper selection and placement of men and women in a Methods and Procedures Department (Planning and Research Department, or whatever the name of it may be) is very important. Go after those who are best qualified to do this work. We prefer to promote from within our organization. Keep your eyes open for these people. They are often scattered throughout an organization and may need a little training or experience. They need not, however, be graduates of methods engineering courses. Select the man who shows promise in his present work and who seems to possess a liking for and an interest in procedure work. Acquaint him with the aims of your department. There is no one best way of doing this. However, regardless of whom you select and how you decide to train him, ask yourself the following questions:

1. Does he have an analytical mind and a good imagination?
2. Is he likely to be open-minded and resourceful?

3. Does he try to think constructively?
4. How well is he equipped technically?
5. Does he plan and organize his work well?
6. How good is his judgment?
7. Is he a self-starter?
8. How well does he get his ideas across?
9. Does he have a high degree of personal integrity?
10. Is he motivated by an inherent attitude of service?
11. How well does he get along with people?

I would like to re-state some of the principles which we think have brought us some success in the past. Methods improvement involves the application of these sound principles:

1. Recognize that methods improvement is a continuing process.
2. Attack problems in a systematic way. Observe, Think, Decide, and Act.
3. Make your procedures definite and uniform.
4. Use every means of communication possible to insure clarity — but the written word will be your main support.
5. Keep your procedure manual independent. If it ever becomes inviolate, even in part, because of *WHO wrote it* rather than for *WHAT it says*, it is doomed.
6. Obtain and coordinate ideas for improvement from many sources. You will be lost without the help of those who process the work.

In our department, we have always contended that no one person has a corner on intelligence. The best interests of our company are served in direct proportion to our ability to have those who actually do the work assist us. In unity we find cooperation and strength. **s/p/a**

Why Forms

Better forms design speeds

► No one should have to be sold on the merit of Forms Control. It is a basic aspect of modern paperwork management. Yet, all too often, companies do not have Forms Control because they feel they do not need it. They give such reasons as the following:

Company A

Company "A" "doesn't need" Forms Control because it's too small; only 600 employees at a lone plant. They use "hardly any" forms. However, let's go inside for a while and look around. Over in one corner of the crowded office is a spirit duplicator. A typist has just put a "form" on the machine and is running it off. She makes about 200 copies and then throws away the master. *She* has made a form, the company has saved money. They didn't have to go outside to buy this form. It cost "peanuts." Peanuts? Gold-plated ones! The form that versatile typist ran off is a blank shipping ticket. A careful check shows that Company "A" uses 20,000 of them a year! A typed master for the duplicating used is good for only 250 copies at best, which means that the girl typed at least *80* masters last

Control Is Essential to Business

up office output and reduces costs.

Ray Marien

year, whereas the situation could have been handled with *one* printing by the proper method. Certainly, in a small office her time could be put to more valuable use. If she had used the gelatin-type duplicator, where 50 to 75 copies is a good run, she would have then prepared anywhere up to *400* master copies. Ridiculous, you say? Well, it's done every day. And by bigger companies than "A."

Small companies like "A" often have another weakness in the field of forms procurement. Almost *anyone* may buy a form when it is too complex to be handled by mimeograph or ditto runs. Sometimes it is the chief accountant, sometimes the sales manager. Usually, it's the person using the form. These people generally rely heavily upon one or two printing salesmen for specifications, layout, and other design factors. Often they don't even check the cost. Is it sound practice to do this? Most salesmen's incomes are in direct ratio to their sales. They can't afford to give you the simplest, cheapest forms. Compare this situation to that of an auto dealer. Can you walk into a new car showroom and expect the salesman to offer you the lowest priced car in his line with no extras or trimmings? Sure, it will get you where you want to go. But it won't get *him* where *he* wants to go—and that's into the higher income brackets! You must *know* what you want if you want to come out with your finances reasonably intact. Unfortunately, very few people know what they want in forms, so they pay more than they should for them.

Company B

Now let us visit Company "B." It is considerably bigger than Company "A" but still not big enough, they think for Forms Control. Besides, they *buy* most of

Ray Marien, member of the Empire State Chapter, SPA, is Forms and Procedures Manager, Olin Mathieson Chemical Corporation, New York. He first became interested in forms control while printing buyer for the American Brake Shoe Company where he purchased forms for 55 plants and 20 offices. He has served as seminar leader for the American Management Association and has lectured at New York University.

their printing. Professionals handle it all around. All right, let's see what they mean. Let's interview the printing buyer. He's in that cubbyhole down at the end of the office. Like most printing buyers, he's not a specialist. He can't be. Printing is only one of the many commodities he handles. Here, as in too many other companies, he's at the bottom of the buying ladder. Everything too small, or too insignificant, (or sometimes, too difficult), for the other buyers is laid into his lap. He writes more orders than the rest of the buyers combined and probably makes the lowest salary. An expert at buying printing? Hardly. Often, he can't even spend time getting bids. Somebody wakes up to the fact that there is only a two-day supply of invoices left. Panic follows. The order is rushed out, at triple the normal price. Even if the buyer could shop, no one could meet his required delivery without overtime or holiday work and premium pay. Super-rush jobs are expensive. An examination of the purchase costs of "B" company's forms shows they are paying about 20 per cent more than they should. But *they don't need* Forms Control! Experts handle it for them!

Company C

Company "C" is really big but it still feels no great need for Forms Control. Why should it? It is so big it has its own print shop! That's the acme of economy in forms procurement. Well—let's take a walk through that print shop and see. Hmm—offset presses, fairly cheap labor, no profit to worry about. It sounds good. But, what's this? Four girls sitting around a table, collating forms by hand, while they listen to recorded music. Very rhythmical, if not productive. They're collating 40 thousand eight-part purchase orders. Oh, yes! It's the cheapest way to do it. Haven't they got the presses and the girls? Maybe the small offset machines can handle only one 8½ x 11 form, one-up, but it's fast enough! For once, the Printing Buyer can't be blamed. In Company "C" he buys only those forms which cannot be handled by the company's own printing department: envelopes, tab forms, and the like. But, this comedy doesn't end here. Let's follow these forms to the Purchasing Department where 40 thousand sets of purchase orders are used each year. Unfortunately, the buyers who use them don't suffer the way the typists do. The poor girls have to insert carbons into each set and take them out after each order is typed. How often? Forty thousand—but we're repeating ourselves. Company "C" had a net profit of millions last year. It's run like a well-oiled clock. (But don't tell that to the typists!)

The foregoing examples are not fiction. Such situations actually exist. They happen every day in companies without a Forms Control Program. These examples describe three common reasons why companies feel they can at least dispense with the reproduction phase of a control program. What about design?

Forms Design

Design? Easy! Each man draws his own. After all, doesn't *he* know best what he needs? The answer is a loud *no!* He may know the *purpose* for which he needs the form but in all probability he does not understand about the design. Another thing, what does he know about paper? Does he know the difference between rag and sulphite paper? If he's a high salaried man, should be spend his time on forms design? No? Well if he doesn't, who will? The office boy?

All right, then. So we are advocating Forms Control. What will it do? Will it pay its own way? Let's assume that our top management is ready to listen. It doesn't concede anything, but it will listen. However, it must be shown. Prove it.

A Control Program

A Forms Control Program will take the designing away from the amateurs and put it into the hands of the specialists. They will make the forms look professional and easier to use.

This may cause some sceptics to lift an eyebrow. Some may even say, "Why do we need 'professional' forms for clerical work?" If this sceptic is in a manufacturing company it may be hard to convince him. So let's leave that up to the big financial and credit institutions and the insurance companies. Paperwork is their assembly-line product. They know its importance just as they realize the need for modern up-to-date offices, with functional furniture, the most modern office machines, air-conditioning, and proper lighting. They know that better tools make better production. And forms are among their tools.

Next, Forms Control makes it possible to obtain printing by the most economical method. A specialist—a Forms Analyst—can arrange this. It's his business. Most buyers cannot, however, simply because they are not in general sufficiently informed about forms design and control. Even if they know printing, they usually do not have the time to design or consolidate forms. Forms analysts on the other hand have the know-how and the equipment. They will consolidate some forms and eliminate others.

To sum it up, forms analysts give a company proper design from two standpoints: efficiency in use and standardization in design and specifications. The printing bill goes down sometimes astoundingly. In addition they constantly combine forms and weed out unnecessary ones. But this isn't all. They establish *control*. The issuance of forms is centralized; no more indiscriminate run-offs on inadequate equipment. It's surprising the effect this control has. Inventories of forms drop because someone knows, from the records, whether a requisition asks for too many forms. The quantity is thus kept under control. Also, since all departments understand that the need for all forms will be questioned, many which might have been printed are suddenly found not to be really necessary and are not ordered.

Very important, too, is the fact that Forms Control exists as a staff function. The responsibility for this control program is thus taken from everyone else and placed where it properly belongs.

But now that a program has been installed and the need established, the trouble is not yet over. Here comes Mr. Dollar-Conscious. "Just a minute!" he says. "We have a program and it's paying off now to some degree, but what about diminishing returns? We're not philanthropists, you know! When the program reaches a saturation point, it must go!"

However, the trouble with his reasoning is that there is no saturation point for a forms control program in a dynamic, growing company. As a business increases and a company grows, so does its paperwork. The need for Forms Control is maintained, even heightened. Let a man say, "We haven't issued one new form in three years!" and we would respond by immediately selling any stock we might hold in his company, because it's standing still. And, this is an age when everyone is growing.

Good. So we should continue the forms control program. We agree that it's a continuing thing. But what tangible results can we show top management? Results? Simple. We keep the over-all program under surveillance and prepare reports periodically. Actual dollar savings are shown, because these are "figures"

that management understands. They are good, hard American dollars added to profit. But let us go beyond that; let us add estimated clerical savings. Let us show where better forms design has actually speeded up office output. Let us lay the groundwork for procedures studies that will lower a payroll. These are savings tangible enough for any management.

These are some of the things a Forms Control Program will do for a company, regardless of size. If the company is too small for a Forms Control staff or at least one specialist, the forms work can be handled on a consulting basis. Employing an expert for a few months, periodically, will take care of a forms problem without the permanent burden of a full-time payroll addition. Larger concerns, naturally, usually handle a program with their own people. A few may, however, use consultants to help them get started.

Any firm can afford a Forms Control Program, simply because it cannot afford to be without it! The waste of money, time, and clerical effort which results from the lack of Forms Control is a constant drag on profits. On the other hand, a dollar saved through proper forms procurement is a dollar saved the next time that form is obtained and the time after. The results are there year after year—cumulative. They keep growing.

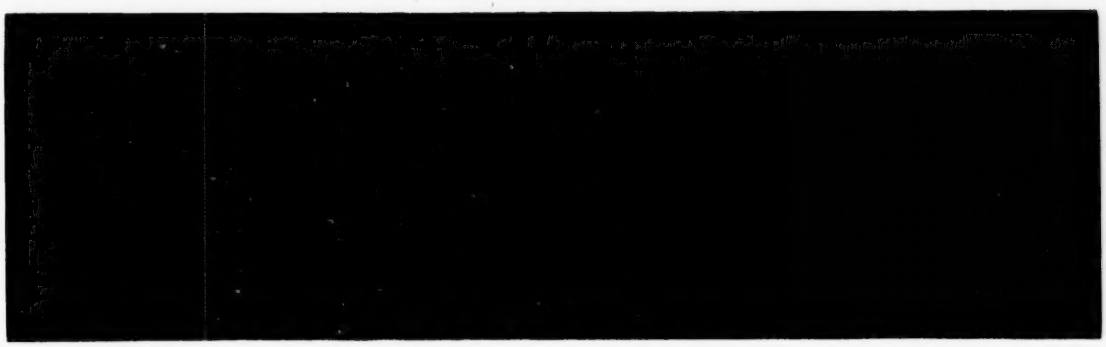
Selling a Forms Control program is sometimes difficult. But then, so is selling life insurance difficult, although most of us know how necessary it is. In fact, Forms Control can be looked upon as a type of insurance with the need for it strong in the business world.

Back in the second century A.D. Marcus Aurelius Antoninus said something like this: " . . . get used to thinking that there is nothing man loves so well as to change existing forms and to make new ones like them . . . . " **s/p/a**

Robert M. Anderson

► Most people are aware of their limited knowledge of electronic data processing equipment and of how it can be applied to their particular problems. This is partly responsible for the initial tendency to approach it in a defensive manner. On the other hand, they have been led, as a result of numerous articles, seminars, and discussions with enthusiastic salesmen, to believe that they must do something or suffer the dire consequence of being "computerless." Our initial approach at Carter Carburetor consisted of a feasibility study with three broad objectives: a) Hardware evaluation; b) Economic consideration; c) Adaptability. A brief story of some of our experiences may be of assistance to others who are at this stage.

Early in 1958, we gave increased attention to the possible use of an electronic computer for data processing problems. Our ultimate decision to install a 305 RAMAC resulted from having progressed through several definite phases of consideration. The sequence in which we pursued these phases does not necessarily indicate their relative importance. All were evaluated, first independently, and then in relation to each other. In any EDPM evaluation the Analyst must strike an acceptable compromise between what



he would like to have and the restraints he is forced, because of internal circumstances, to place upon the system. (It is not unusual to think of these restraints solely in the form of costs. A mental dollar-sign barrier is frequently built, limiting the scope of the analysis even to the extent of obscuring the entire objective.)

The Feasibility Study

At Carter, the feasibility study required about 300 man hours. Two employees had previously attended a training program conducted by a manufacturer. With one week of instruction in hardware and programming techniques and with only one person having any prior experience in EDP, we were anything but "experts." Fortunately we had a considerable background in EAM systems and a good knowledge of the methods then in use in the company. This appears to support the opinion that, in considering personnel for any EDP program, employees within the company have an advantage — a knowledge of the company, its policies, and methods.

We could only scratch the surface in 300 man hours. To minimize the time involved and the cost of the preliminary study, we were satisfied, therefore, to achieve only one objective: to decide whether we should proceed into a full-scale study. We further restricted our study to an area of data processing which most nearly satisfied our need for a model or typical application partly because it was already well disciplined and cost data were available. Business administration must, to be successful, give attention to fundamentals. Regardless of what cloud you may select from which to theorize, in the final analysis it becomes necessary to get down to fundamental realism; for example, salaries, invoices, accounts receivable, and accounts payable. When the cover is peeled back there is nothing glamorous about these functions. Methods of performing them do not vary greatly from company to company except in complexity. Of course, the hardware differs and represents new concepts, but the systems we work with, for the most part, do not — although they may in time. Our present methods may become obsolete and we may eventually develop a brave new world of information processing. First, however, people must change, wants must change, and government needs and

Robert M. Anderson, a member of the Systems and Procedures Association, is Manager of Systems and Procedures, The Carter Carburetor Division of the ACF Industries, Inc., St. Louis, Missouri. His last article, also a case study, entitled "Program for Control of Machine Utilization and Employee Efficiency," Systems and Procedures, August, 1958, was awarded the annual Price Waterhouse & Co. Honorable Mention Scroll.

restrictions must change. In the meantime, we must face facts. EDP will either economically give us a new tool to handle existing business practices or we must relinquish it to the scientists and research programs.

As previously mentioned, our initial 305 RAMAC feasibility study at Carter was to determine the advisability of going further into the program. In the end, the results were not that clear cut. From a cost point of view we were willing to accept a "standoff"; that is, break even by applying savings in one area to offset the cost of the equipment. Unless you are an expert in expressing savings in specific physical terms, such as number of machines and number of people, you may be lulled into a false sense of well being. Caution should be used. Hours saved are not necessarily people, machines, or dollars. Savings in personnel do not always materialize, at least proportionately. It is also difficult to maintain the proper prospective when dealing with fractions of people. There are problems in determining what EAM equipment can be released if EDP is to be adopted. If you have a small EAM installation, hours "saved" may allow you to take on more work but seldom will they allow you to release a machine (you may only have one or two). There are the additional problems of peak work loads, scheduling, deadlines, and the risk of overloading one machine with no reserve capacity. You may even mistakenly consider as hours saved those that were part of a second shift or of overtime. Naturally, if you eliminate these you can show a savings, but not in EAM equipment. If you have a large installation, some of the same problems exist. In addition, there is the added risk of considering total hours saved as being in one lump sum whereas they are an accumulation of numerous short intervals spread over several machines and over an entire month. Be wary also of an estimated total personnel and machine hours saved multiplied by an hourly cost and of showing this as "savings." We at Carter fell into some of these traps. We soon learned to become extremely wary and critical of such comparative savings.

While our preliminary study was limited, it did point to one thing. Facts, or lack of them, were our bottleneck. Not enough of the right information was available for evaluating alternate methods. Information had to be gathered by laborious and time-consuming methods. We used statistical techniques in developing probability of occurrence but, for some reasons, the results did not coincide with what we suspected. It is surprising how little people actually know about their operations, particularly from the standpoint of quantity and time. It seemed to us that we spent most of our time gathering data and using it in various ways to form conclusions about the "predictable" nature of input data.

We spent considerable time and effort on the problem of memory organization and addressing. We found that, for our purposes, applying a direct address off-line was preferable to all other methods we explored. We found that we could spend time off-line and accomplish the over-all job at considerably less cost with the added advantages of memory conservation and a straight-forward approach. It appears that there must be a constant awareness of alternate methods which exist between off-line processing and the use of the RAMAC and probably any other EDP equipment. The decision cannot be based solely on cost but must consider the many other related factors involved.

The Findings

The second phase of our preliminary survey was perhaps the most critical.

It consisted of evaluating results and findings. It was apparent even before we completed the study, that we could not expect significant savings. Our Systems and Procedures Department, working with manufacturer representatives, reviewed the survey findings from every angle. Frankly, like everyone else we were probably more concerned with justifying it from a direct cost standpoint than from the often-voiced intangible benefits point of view. We would like to believe that we approached the problem void of all lofty data processing dreams and very objectively, sometimes critically, stayed close to the facts. We were not selling an EDPM system, we expected the system to sell us. It is, of course, very easy to rationalize an evaluation, and a final report, no matter how objective analysts have *tried* to be, could still reflect the biases of the manufacturers or of the analysts.

While we had mountains of data and sufficient flow charts to paper the office, our final survey report consisted of a few pages of facts, conclusions, and recommendations. We long ago discovered that management cannot be sold by pounds of paper. Our systems survey resulted then in several basic conclusions:

a. The requirements of the system were particularly compatible with the electronic equipment being considered.

b. A comparison of costs revealed that we could expect some savings and, in total, at least no additional cost.

c. We recognized that electronic data processing had greater potential in our Division than might have been suspected previously.

d. The survey created at Carter a new atmosphere concerning EDP.

e. We would recommend the installation of the equipment.

In view of these conclusions and other factors, some of a long-range nature, management agreed to accept the recommendations.

The "Engagement"

It was fully realized that eventually Carter would outgrow the present equipment and that we must immediately give serious attention to our future course of action. Our acceptance of the RAMAC, for the interim period, was due, in part, to the axiom of "learn to crawl before you walk or run." However, we had no intention of carrying the equipment just for experience or for "elegance." The acceptance was strictly on its own merits and its ability to do the job. Concurrent with ordering it, an order was placed for a 650 RAM tape system. This action was taken because we realized that there was a need to parallel new techniques and systems in manufacturing and inventory control, product sales, and distribution, with more powerful data processing tools. Perhaps we placed ourselves in the same position as other companies in similar circumstances; that is, tentatively committed ourselves to an EDP system, of considerable cost, before completing a full-scale study of the equipment and its applications. Perhaps, at one time and under different circumstances this might have seemed ill-advised, but then, every engagement does not mean a marriage. For one thing, we were not totally lacking in both system and programming experience on the 650 tape system and, since we had a RAMAC on order, we were now "experts" on the RAM. Secondly, we were fully aware of the scope of plans for extensive system revisions in manufacturing control and other critical areas. In our case, we were, with one reservation, willing to become "engaged" without the expense of a long courtship. If the subsequent feasibility

study did not support the installation of the system, we would, as gracefully as possible, back off and reappraise our position.

Once we had formally accepted our new equipment as the interim equipment and received a promise of its approximate delivery date, we began the job of designing the system and writing the program. This was the third phase of our study. As previously mentioned, our problem of system design was primarily the problem of modifying our present system. Many of the changes made could have been made anyway, RAMAC or not.

The Initial Application

We used certain criteria in selecting the initial application. We wanted to be assured of disciplined source data, already properly controlled. We wanted a solid system foundation upon which the program could be developed. At this time we were not interested in extensive system reforms or "new concepts." Also, the present expense of performing the selected function must be costly enough to warrant converting it to the RAMAC. We finally selected what is referred to as "Labor Accounting and Distribution," which previously consisted of a number of independent EAM applications associated only because they were related to the processing and reporting of employee time and production. It may be difficult for some to understand and appreciate what this type of information means to a manufacturing organization such as Carter Carburetor. Nothing happens without recording time and/or production. We do not manufacture or assemble a part without recording the time required and the quantity produced. We do not make a tool, move material, perform inspections, or sweep a floor without recording the time, the work order, and the expense classification. During a normal day about 5,000 individual records are created to reflect the performance of some type of direct or indirect labor. In one week it is possible to generate and use over 30,000 records reflecting labor which has been expended on any of the 50,000 identified production operations or 3,000 work orders or expense codes. These records are the basis for wage payments, labor distribution, standard labor cost, variances (which in turn affect inventory), departmental earned hours, work order cost control and distribution and, in reality, every accounting and recording function where labor is the common denominator.

The heart of this program of record keeping is in the computation of earnings. Every one of the 5,000 daily records reflects earnings in one form or another. They may be at an hourly rate or from a production incentive operation. They may be earnings shared proportionately in one of numerous "groups" of the production areas. The earnings represented by each record include such things as cost of living "adder," shift differential, and minimum guarantees (MRA).

We began to flow chart these activities in March, 1958. The term "flow chart" may be confusing here to those who interpret it as the process of describing graphically a preconceived system or series of operations. We think of it as a technique of system design or as the development of the logic of a system. While it was not our intention to revamp completely the existing system (series of systems) there was a definite need for a "linking method" to tie together previously disjointed functions. This is probably true in any EDP system which must integrate sequential operations peculiar to EAM equipment.

In the process, some changes in present methods were naturally made. Most of

them were not aimed primarily at improving the system, but at making it compatible with the new program. The most significant change involved a revision of our employee clock numbering system. Since employee record "seeks" would be completely random, with the same record required several times a day, employee clock numbers were revised to correspond with the memory address. This change created some confusion among employees, in spite of advance notice. Records throughout the Division had to be changed and, all in all, what seemed simple in the beginning created its own share of difficulties.

Extensive changes were made in punch card record forms. To a large extent, the design of the input record was predicated on how the data were to be manipulated by the program. This consideration was important to conserve the number of program steps and to reduce processing time.

In the process of designing the system, we attempted to catalogue present reports and "end products" into two main groups:

a. Those which would remain in their present form or involve only minor variations.
b. Those which would be eliminated or drastically revised.

We had some luck in the latter category, but not as much as we would have liked. We encountered a certain degree of "maternal instinct" towards long-established reports which was difficult to overcome. In addition, there apparently always are those "must" reports over which we had little or no control such as those required by law, union dictates, or "sacred" precedence. Any expectation eliminating all reports of a certain type will probably usually meet with only partial success. And it is likely that additional reports will eventually find their way into a system, or if not that, more information will find its way into the remaining reports. With more manual methods, requests for this additional information generally met with problems of equipment limitation and cost of preparation, but, with the installation of a computer, everyone feels that these bars can be lifted; that the previous problems are eliminated. This may have been equally true when we converted from the quill to whatever was the next step in technological advancement at that time.

The design of the system and its complete programming required approximately 1,200 man hours. We stretched this over a six-month period, with intermediate testing at the manufacturer's centers. The 1,200 man hours did not include time spent by manufacturer representatives. Their services were primarily advisory. We could probably have "crashed" the program through in ninety days if it had been necessary. It is doubtful that it could have been accomplished sooner.

As was mentioned previously, a vital part of the programming phase consisted of the development of flow charts — many, many flow charts. They became so valuable that we reproduced them for safekeeping. All of our flow charts were extremely detailed so that when the time came to program each step, the task was almost automatic. All of our logic was proved on paper and the conversion to machine language required only a knowledge of coding. This approach was probably responsible for our ability to become fully operational within two weeks after the equipment was delivered.

Some Problems

In designing the system and subsequently the program, we faced certain prob-

lems which were directly tied in with the capacity of the equipment. I have already mentioned speed which, in turn, has a bearing upon cost. The only way to recover the cost is to use the equipment. While this is not a profound statement, it must be recognized that cost should be measured on the basis of "use hour" or possibly on "input unit." In any event, EDP cost should be measured against some unit of performance. We selected "productive hour." This term merely meant that an hourly rate was established in relation to a unit of production which would absorb all the cost associated with that use. The cost of idle time and maintenance must be absorbed only when the equipment is producing end results. This creates a significant hourly rate and acts as a real incentive to separate the wheat from the chaff.

There were other problems associated with the hardware. Many of our problems seemed to fall into the category of "short of." We were "short of" selectors, distributors, program exits, and program and general storage tracks. In most cases, the problems were solved by ordering more. This did not, however, apply to program storage tracks, and this still remains one of our most critical programs. In most of our main programs we have used all, or nearly all, of the 200 instructions available to us. In one case, we required 342 program steps. In that case, we divided the program into three phases, making sure that no one program step in any one of the phases was dependent upon a program step in any of the other two. This is not always easy, particularly if extensive branching or subroutines are used. Each phase was "called out," one at a time, in a constant loop.

At the moment, two of our main routines consist of 197 and 200 program steps respectively. In one of these instances, any attempt to call more program steps out would add an additional 50 per cent to the present processing time. Since for this one routine alone the processing cycle is already three hours, a fifty per cent increase would be extremely costly.

Parallel Processing

The 305 RAMAC arrived in September, 1958. Space had been set aside and more than adequate electrical power and air conditioning provided. Within 3 days the equipment was in working order. Because of our extensive pre-testing, we were able to "test out" all of our programs and plugboards within another three days. Since our programs were quite complex, we felt that this was an accomplishment. Most of our pre-tests had been with simulated data and we had no idea of the problems we would encounter under actual conditions. We ran full-scale tests for a few days prior to starting "parallel processing." Not only did this isolate the "bugs" but it also allowed us to "shake down" the equipment.

By the end of the first week we were ready for "parallel processing." This was for some reason difficult. The equipment had certain requirements and different card forms from our previous (and still in effect) system. Obtaining timely and accurate input became almost impossible. We got further and further behind. Corrections were made on one record without being made on another. People "forgot" that the equipment needed certain data presented in a specified manner. In some cases vital records by-passed the RAMAC altogether. Positive action was needed. First, we aborted our initial effort to parallel and started over. Personnel operating the new equipment processed the source data into the form needed by it. The fact

that they were familiar with the requirements gave us an even chance to get the thing off the ground. The actual operation of the RAMAC was, however, taken over by the Systems Analysts who had originally designed and programmed the system.

As a team, this combination together with double shifts, starts, and restarts, managed, at least, to end the tune even if a few of the notes were sour. So we finally paralleled the existing operation for one week. It proved two things:

a. The efforts required to parallel both systems created pressures that actually worked against us.
b. The logic of the equipment program was sound and what it processed was more accurate than the system we were trying to parallel.

We decided to parallel for one more week, except in reverse. Primary consideration was given the new equipment and the previous system lagged behind. We intended to place the RAMAC on its own, but to have it backed up in case of an emergency. The emergency never occurred.

We read where one company paralleled its payroll for three months. We can understand why too. Actually a two-week parallel is cutting things a little short, particularly in dealing with as many records, reports, and products as we are handling. Payroll, while important to those who are being paid, is probably no more important than work order control, standard labor costing, or expense distribution. The decision about how long to parallel depends upon the confidence one has in his program and planning, the risk consequence, and the cost involved. Each situation will probably differ.

When we were finally operating under a full-head of steam, other problems took the place of those we had solved. Scheduling seemed to take on added emphasis. The availability of source data was no longer a question of day, but hour. It was imperative to meet deadlines and to adhere to reporting disciplines. Like others, we encountered our share of processing problems. The lack of timely and accurate source data probably contributed the most to our difficulties. An uncompromising attitude about accurate information for the machine is imperative. This requirement is probably fundamental in all EDPM operations. There is little doubt that the RAMAC has the ability to isolate discrepancies and in certain cases, to take alternate routines. However, at this point in the process, it may be cheaper not to know about them since it might disturb our sense of "rightness." We must provide other techniques.

We use what is referred to as "off-line editing." We go to any extent to keep bad data out of the equipment. We make compatibility checks "off line," we sequence-check everything we sort, and we establish and prove totals "off line." In addition, we have provided tighter process controls than we ever had before. Some may scoff, but if the "monster" never stops or blinks its "tilt" eye because of bad data, everyone concerned will be happier and the company will be money ahead.

* * *

There has been a passage of time since this article was started. The RAMAC at Carter Carburetor has since settled down to its routine like the rest of us. It has picked up a few scratches along the way and has lost much of its glamour and sophistication. We are now in the process of looking into other applications which will be programmed for the RAMAC in the near future. We have gained much by experience. It is hoped that our experience will make the way easier for those who follow. **s/p/a**

The Information Machine

Man is essentially an information machine.

Dimitris N. Chorafas

▶ When the history of our age is written, it will record three profoundly important technological developments. Atomic physics which contributed to a tremendous increase in the amount of *energy* available to do the world's work, the beginning of *space* exploration through means of the first earth satellites, and *computers* which multiply man's mental ability to plan and control work.

Memory and Imagination

Man is essentially an information machine. But, since early times, man has been constrained in his actions through his limited ability to speculate. Speculation requires imagination, memory, and calculation. Man has plenty of imagination but his ability to calculate is not outstanding. To counterbalance these limitations men grouped into teams, teams grouped in organizations, and organizations grouped into large-scale systems. Industrial complexes which are modeled essentially upon centuries-old military lines find themselves bogged down in interminable communication problems. Paper work has proliferated; clerical forces have passed production forces in number. As much as half the cost of administering some companies can be charged against the processing of information, and the results are not essentially good. Man requires more information in order to handle increased amounts of other information, and this process in itself generates more information. The traditional information process is the least satisfactory in respect to forecasting. The rampant paper jungle is able to mask itself. The hope, therefore, that the electronic computer might control this man-made communication jungle awakens tremendous enthusiasm in business and industry.

Just like man, the computer is another information machine, but unlike man it

Dr. Dimitris N. Chorafas is with the IBM World Trade Service Corporation, Paris. His academic degree is a Docteur Es Sciences in Mathematics, Sorbonne, although he has studied engineering and management in U. S. universities. Retained by the Catholic University of America, Washington, D. C., he has taught graduate courses there in mathematics, operations research, and management. He has visited industries in France, Italy, West Germany, Switzerland, Belgium, England, Spain, Canada, Denmark, and Sweden. The author of numerous articles and seven books, his latest book is Operations Research for Industrial Management, *303 pages, Reinhold Publishing Corporation, 1958.*

does not have imagination. It only has memory and calculating facilities. It can read, write, do elementary arithmetic, compare, make *yes* or *no* choices, and transfer information from one place to another faster and more accurately than human counterparts. Thus computers can supplement man's memory and calculation capacities to a virtually unlimited extent and because of this may become the basis of all scientific progress from now on.

Computers can comprehend a situation but they cannot conceive it; man has to supplement the conceptual factors through programs and models — through simulation.[1]

Data and Patterns

High-speed computers get a few answers from a vast amount of data or a number of answers from limited data. The former is known as data reduction; the latter as data generation. For a data reduction example take an earth satellite that is constantly beeping out information on conditions in space as it meets them second by second. A computer absorbs this tremendous amount of information, collates it, processes it, and finally reduces it to a meaningful pattern. At the other extreme, consider the computer at the Cape Canaveral missile test center. It receives rather limited information on the path of a fired missile and on the basis of this information forecasts its exact trajectory. This is, it generates data on the future behavior of the device and if this behavior is forecast to be harmful in any respect to its creators, the computer would generate a signal which would immediately "self-destroy" the missile in the air.

[1]Simulation for business and industry is presented and discussed in simple terms in the book: *Operations Research for Industrial Management,* Dimitris N. Chorafas, Reinhold Publishing Corporation of New York, 1958.

High speed electronic computers have four broad areas of applicability. The first is scientific analysis, including engineering design. Men will still determine the "roads" of scientific destiny, but machines will implement them. The second is business data processing. Modern computers hold the key to new systems of communication for the sprawling giants of industry, commerce, and government; structures whose explosive growth over the past three generations has sometimes seemed to defy orderly control by the small groups of men at their tops. The third is technological control. This includes complete factory automation through real time control, traffic automation through computer networks, and control over physical environment through means yet to be conceived. The fourth, and perhaps the most promising area for man's future, is experimentation; that is, experimentation through mathematical simulation. Research on future systems from socio-cultural to techno-economic is one aspect. Research on present systems, preoperating technological and other ensembles to enable man to speculate in a rational manner, is another.

Business Data Processing

Although much of the "ground work" will be done by machines, the human element is and probably always will to some extent be present. This human element can be divided into the group which consists of humans supervising minor and medium-size loops, and "stand-bys" ready to take over in case some of the automatic controls fail. The latter may be thought of as preventive and corrective maintenance units; the former as top and middle management and their immediate assistants It is the duty of the "management" group to evaluate market reaction, to determine the optimum course of an enterprise, and to develop managerial skill.

Also, it is its duty to plan and control company operations and to keep the firm in a top operating condition with respect to equipment, technological skill, research, and the development of new products. Generally speaking, in its decision-making, this group is subject to prejudices and bias. Subjective bias may be thought of as equivalent to noise in a communcation system.

If a computer is used in the central nervous system of an enterprise, the managerial group can be divided into two subgroups. One could comprise routine managerial operations which can be taken over by the computer. The other could include cases which require exceptional managerial skill and imagination. Modern management theory, operations research, and advanced technological skill can assist in performing these duties.

A computer used for the direction and control of a manufacturing process needs to be connected to that process by proper sensory and effector means. Information fed into the computer may be signals transmitted by on-the-process transducers or by certain manual inputs. In some cases it can also be computer-developed information. An automation ensemble must have its proper sensory devices, its motor activity, and its central nervous system. Sensory devices are often known as receptors, and motor output units are known as effectors. A computer is used for the central nervous system. The pace of receptor and effector set the tempo of the machine system. Computers that can meet "deadline" requirements, usually called "real-time" or "on-line" computers are growing rapidly in importance. A computer is said to be in real-time when it is an integrated part of a physical operating system. Such integrated operation is essentially the core of automation.

For an automatic system, the transducers (contact elements of the central computer with the controlled system) are the equivalent of the sensory devices of a human. The data they transmit, like most instrument data, are fundamentally analog in character. If a digital computer is used as the central information processing unit, analog information must, of course, be converted to digital form. If a human linkage is used, it may be necessary to provide some kind of information display with information presented in decimal form so that the human operator may understand it better. If human linkage is eliminated, the computer output should be able to initiate corrective action. Furthermore, if the computer is going to affect a process on the basis of historical data as well as current information, dependable files must be provided. Such files can be thought of as peripheral units connected to the computer through a file co-ordinator. They may at times become extensive and hence they should be of a low-cost-per-file material but available for ready access by the computer.

A Real-Time System

Computers operating on real-time have a substantially broad applicability; that is, they go far beyond the area of factory automation, airline reservation systems, traffic control, and department store operations. The largest single area of application for real-time systems at present is probably that of the military. For example, one existing automatic system places missile batteries in a waiting line to evaluate whether a missile will be fired according to input data which are automatically processed according to complete instruction programs stored in the computer. To appreciate the difference between this and the traditional airplane-tracking process, consider that during World War II airplanes were "sensed"

through man-machine units. The information was transmitted often verbally or by telegraph, to a monitoring unit composed almost exclusively of humans. The latter initiated fire commands for man-actuated anti-aircraft batteries.

As an example of a real-time system on a relatively small scale and for a non-military operation, consider the case of airline reservations. Local offices receive customer information with respect to reservations and cancellations, which is then forwarded to a central computer. Often this information arrives in a simultaneous or overlapping manner so that some intermediate units are necessary between the local office and the central computer. An input-data coordinator, able to receive the information from the local offices and space it sequentially in time, is needed.

Media for data transmission are needed next. Such media can be local telephone networks, private communication systems, coast-to-coast telephone or telegraph networks, and in the future possibly earth satellites with magnetic tape and radio receiver - transmitter. An input - output adapter may next be needed to decode since, for economy, feasibility of transmission, and security, the information thus far handled by the data coordinator and the transmission system may be coded. If so, it needs to be decoded before entering the computer. Sometimes the input-output adapter may have to perform other jobs than decoding. For example it may act as a second data coordinator if information is received from several regional offices.

Perhaps one of the most difficult parts to design in a whole ensemble are the input-output elements. Generally speaking a reservation system, either for airlines or railroads, must have input-output units designed so as to facilitate wanted input and to inhibit unwanted input. In studying an automatic or semi-automatic system, consideration should be given to all sources of error which were present in the previous all-manual system. Most of the errors were human, but other errors were inherent in the operating characteristics of the system.

Time sensitivity can be used as a measure of the on-lines of a system. In some real-time control systems this is a primary characteristic. For example, time sensitivity is much more critical to a stock exchange monitor than to a transport reservation system. Recently an electronic digital computer has been used as the central data processing unit for a system designed to monitor the data (ticker) of the New York Stock Exchange and to produce hourly and daily indices. By two different operations, the ticker data are printed and also recorded on perforated tape. This tape is processed on a specially designed reader and converter. The output of the converter is adjusted punched tape. It constitutes the input to the electronic computer. The memory of the computer is divided between the master program, the master price file, the special program, the raw information (adjusted ticker data), the grouping of information, and the price file or final output.

As another example of the use of computers in a real-time system, consider a department store setup for sales recording and inventory control. The human operator (salesman) inputs information into the computer from a point of sale. For this operation he can use either a keyboard or punched cards. This input is processed through a coding network so that the data will be coded in the form required by the internal design of the system. Then the signals are processed through a coordinator device. Since the

system cannot accept multiple input-output units simultaneously, a buffer unit is necessary to route input data in a time-sequential manner. Finally the signals reach the central computer where they are proocessed. The path of the output is pretty similar to that of the input. Visual displays or punched forms are feasible output means. Probably the most noteworthy contribution of such a system is the error-free financial and physical control which it can provide.

Another coming major application for real-time is traffic control. Computers can be used to advantage for traffic control in either of two processes: manual or automatic. In a manual traffic control system the computer will collect, collate, and process input traffic data and then output the necessary instruction which may be transmitted to the drivers. In this manner human linkage will exist both before and after the electronic data processing. In completely automatic traffic control, however, the computer will actually drive the cars with humans (including the car driver) playing no role in the driving process.

Helicopter data collection, radio flash news on traffic, and perhaps mapping by closed TV networks are within the "manual" mode of traffic control. In these cases the real-time played by the computer will consist mostly of the handling of traffic data at electronic speeds, and of data processing through simulation models to forecast density of traffic flow and possible bottlenecks. Computer-directed neon lights on highways and parkways can light appropriately. Radio signals may become of universal use by making the radio mandatory to the driver.

The use of a destination indicator in the vehicle which will be able to communicate with a central computer, is probably the first step towards automation in driving. The automatic mode of traffic control involves driving done by a computer but a manual-automatic combination is also feasible. For example, "straight ahead" can be automatic; whereas, entrance and exit from a superhighway, changes in direction, and driving in intermediate streets can be done manually with computer controls. Driving in local streets can remain plain manual as at present. However, even a semi-automatic system here would provide automatic tracking and collision prevention.

Some Small Industrial Applications

In recent years, then, many numerical control systems have been finding their way into industry; all are made feasible by the information machine. Insufficient understanding of interactions between systems, computers, and different input-output problems has slowed down their development.

Small industries can take advantage of several areas of automation, studying and adapting them to their own needs. Probably one of the most versatile and suitable techniques for small industry is the numerical control of machine tools. There are several advantages in the application of numerical control methods in machine-tool operation. First is the elimination of retooling. In certain industries, machine requirements are such that setup time may be longer than actual production time. A job shop schedule is an example of this type of production. The machines are set up, a small quantity of parts is made, and then the templates, jigs, and fixtures are changed and a different batch of parts run off. Numerical control can reduce the time, effort, and expense accruing under these conditions. Numerical control enables the machine to become a flexible unit more valuable to the production engineer.

Specifications from man-made blueprints may be transferred to punched tape. This tape may be processed through a computer, to produce a master tape for machine-tool control. The tape, when fed into a "reader," or a unit associated to the machine tool, positions and commands the tool through its proper process.

Conclusion

Where industry is going in manufacturing controlled machine tools is summarized by one builder as follows: "When we say automatic, we are implying there is no operator, so let's take off the machine everything that was put on for him to work. Let's redesign the machine around its basic function . . . . Turn it upside down so the chips fall out instead of falling in . . . . Let's make it easier to get work-pieces in and out. We'll have to start from the floor and do over the entire machine."

Where society is going with the advent of the electronic information machine can be deduced by studying the history of human civilization. From earliest times man has ceaselessly applied his ingenuity to the task of improving his means of production, his skills, his tools, and his machines. Aristotle dreamed of the day when "every tool, when summoned, or even of its own accord, could do the work that befits it." In the long run, automation promises to make Aristotle's dream a reality. Like every other important technological innovation, from the steam engine to electronics, automation will create a number of jobs, far more than any it can possibly displace. It will make a number of old jobs more interesting and less arduous. It will create new products and new services. It will allow industry to produce more goods for a wider market, and with less human toil. Improved technology has always been of benefit to man.

s/p/a

Richard W. Reynolds

Electronics in Business, *by Gardner M. Jones: Michigan State University, East Lansing: 106 pages, 1958, $3.50.*

► The purpose of this short book is to assist those who are interested in the organizational consequences of electronic data processing. Machine descriptions and technicalities are kept to a minimum but there are many references for those who wish to delve further.

With the centralization of record keeping required for electronics and the building of a system around the computer, it has been found that the accounting, sales, production, personnel, and other departments must not operate as separate functions. "Compartmentalized training and thinking are not in accord with the way business operates."

With the advent of small-scale computers and the greater use of service bureaus and with "increasing reliance being placed on the outside accountant as a consultant, not just as an auditor or tax specialist" it is suggested that accountants in particular should prepare for electronics.

Mr. Jones sets out several prerequisites for an educational background or re-education in an electronic era, e.g. higher mathematics, systematic thinking, psychological and sociological sciences, economics, systems analysis, and others. *(Reviewed by J. R. Murray, C. A. Toronto, Ontario).*

Investments For Professional People, *by Robert U. Cooper, M.D.; The Macmillan Co., New York 11, N. Y., 358 pp., (revised 1958), $4.95.*

This book should help the busy executive and professional man become familiar with the various types of investments for planning an investment program. In a nutshell, it outlines briefly the various financial areas that the average professional man should know, such as life insurance, banking facilities, wills, income tax, and investments.

Typical informative chapters are those on insurance and investments. For example, the insurance chapter covers explanations of the different types of insurance policies one encounters and how to select the proper policy.

An interesting area of the book is that on investments. Too often professional people and executives are not fully informed about such terms as common stocks, bonds, preferred stocks, and investment funds. This book explains each of these areas sufficiently to understand them. Of course, any investment of large magnitude should be undertaken with the guidance of a qualified financial advisor.

The section on "Capital structure of Corporations" uses the illustration method to enable the reader to understand easily the organization and development of a corporation. It takes the reader through the set-up of a company, preparation of a balance sheet, and the meaning of various financial terms encountered in the operation of a business.

Another important section of the book is on wills and estates. Too often, people do not realize what happens to their estates either with, or without a will. Everyone who has a reasonable estate will find this book helpful in planning a will or the distribution of the estate.

In general, this book makes interesting reading for general information on various financial matters about which we should all know something. However, one should not expect to become an expert in any of the subjects covered in the book as a result of merely reading it. *(Reviewed by Victor Lazzaro, Merrill Lynch, Pierce, Fenner & Smith.)*

Management Principles and Practices, *by Dalton E. McFarland; The Macmillan Co., 60 Fifth Avenue, New York 11, N. Y., 612 pp., 1958, $9.25.*

Mr. McFarland's primary purpose in writing this book was to develop a text for first-year management students. He has fulfilled this purpose very well in a clear and easy-to-read text.

The breakdown of the material is based on modern management practices. He briefly discusses Taylor and his contemporaries up to the present day. By reviewing actual experiences and techniques and by applying them to a framework of principles and fundamentals, this book will aid students in becoming acquainted with and meeting a wide range of management situations. The ultimate goal of students and practitioners alike is to be able to observe and analyze what is going on and know enough about management principles and practices to be able to organize and carry out appropriate actions. The author has approached this "ideal" by developing material on the nature and significance of the management process, on the knowledge of major principles and concepts of organization and management, and by viewing cross sectionally the vast field of management.

The book is recommended for students, the casual reader wishing to broaden his knowledge of the management field, and

those who wish to refresh their views on management and organization principles. *(Reviewed by Edward A. Jacobsen, Knickerbocker Chapter, SPA, Operations Analyst, Remington Rand, N. Y.)*

Opportunities in Office Management, *by Irene Place and Charles B. Hicks; Vocational Guidance Manuals, Inc., 1011 East Tremont Avenue, New York 60, N. Y., 92 pp., 1959.*

This manual answers numerous questions which would arise in the minds of readers contemplating a career in office management. The authors have been careful to present both advantages and disadvantages to such a career. This reviewer searched in vain for a statement as to the type of audience to which its contents were directed. It is assumed that this outline guide will be used at the high school or college levels. The authors have gone all-out in presenting an idealistic interpretation of office management with which there will be many dissenting arguments. For some years the all-inclusive interpretation of office management has been discussed but not successfully sold to management. With the tremendous increase in clerical workers in ratio to the factory workers the importance of the office manager's position has not increased to the same degree. This is not to say that it should not have increased, possibly because these careerists have not kept pace with developments arising from an increased clerical population.

The volume itself covers all phases of office management that would be of interest to readers. Starting with the historical background of the career, the manual presents to the reader collateral information that he should know regarding the type of conditions to be met in the career, education recommended, compensation to be received, and a list of professional associations in which the office manager would be interested.

This book will fill the need of a school library or counseling service where a complete exposition on opportunities in office management is required. *(Reviewed by J. P. Jenkins, Olin Mathieson Chemical Corporation.)*

Systems and Procedures (A Handbook for Business and Industry), *Edited by Victor Lazzaro: Prentice-Hall, Inc., 70 Fifth Avenue, New York, 464 pp., 179 illustrations, 1959, $10.*

Written in the brisk style of most handbooks, this book does not waste words. It presupposes sufficient business experience on the part of the reader to carry on by himself once a simple but detailed analysis of technique in any one area has been set forth. In this manner, basic, very readable guides for systems activities in sixteen different areas have been put into one book.

Each of the 16 chapters has been contributed by a different, well-known systems authority. Topics are: *Systems* Concept, Department, Study, and Charting; Management Audit Forms Design, Work Simplification, Records Management, Manuals, Cost Control, Tabulating and EDP Theory, Measurement and Sampling, Management Research, and Training of Systems Personnel. No attempt has been made to include accounting systems except briefly in illustrating the use of tabulating equipment. Also, an experienced Systems man may well be able to list many management or industrial engineering areas which overlap systems work, and which systems people should know, but which have not been covered in this book. On the other hand, the systems techniques and background presented should help any conscientious person do better systems work.

The scope of this book and the fact that it sticks to basics warrant its inclusion in every systems and management library. It will provide an efficient source of technical review in areas which may have become unfamiliar because of inactivity. It seems to be a perfect text or adjunct text for certain classes in systems education and might be regarded as indispensable for the ambitious Systems junior or trainee. It would also make an excellent gift for a supervisor or department head who wants to learn more about those "mystery" techniques you use as you study his area of responsibility. *(Reviewed by Richard W. Reynolds, Empire State Chapter, SPA, F. W. Lafrentz and Company.)*

s/p/a

Worth Reading

S. Joseph Schneider

"New Copy System Speeds Work Flow and Reduces Errors," *American Business,* January, 1959.

▶ Brief statement of experience with Xerox Copyflow by Aviation Gas Turbine Division of Westinghouse. Claims offset masters are now prepared for 9 cents instead of 40 cents and that 100,000 documents are copied monthly for 3 cents, including all costs.

"Cut Costs By Measuring Office Work," C. J. Berg and E. V. Grillo, *American Business,* April, 1959.

First of two articles on work standards for the office and methods of reporting performance. The material is condensed from a new book by the authors *Work Measurement in the Office* (McGraw-Hill). Includes forms for "Daily Report of Performance by Position" and "Departmental Weekly Performance Report."

"How You Can Distinguish Between Fact and Opinion," Charles H. Lang, *American Business,* March, 1959.

Distinguishes between facts, assumptions, and value judgments. Stresses the value of identifying the unstated assumptions implicit in much of our daily work, and the importance of separating the factual (verifiable) from the non-factual in reaching sound decisions.

"How to Create and Maintain a Manual to Keep Good Systems Intact," Walter S. Athearn, *American Business,* January, 1959.

General discussion of the following aspects of procedure manuals: what to include, control of manuals, issuing and distributing, binders, indexing, dating, design, and style.

"Should the Controller Govern the Content of Staff Reports?" Harold W. Fox, *The Controller,* May, 1959.

Presents pros and cons of enlarging the role of the controller to include control of staff reports on broad business problems submitted to management.

"Maintenance Management and Use of Standards," E. T. Nebrough, *Industrial Management,* March, 1959.

Briefly discusses the following aspects of maintenance management: organiza-

tion, training, base rates and salaries, procedures, planning, scheduling, work measurement, preventive maintenance, equipment control, and maintenance cost controls.

"How To Use the Seven Secrets of Persuasion," Ted Pollock, *Management Methods,* April, 1959.

Presents results of a Yale study on methods of persuasion. Considers, among other aspects, when to present both sides of a story, when to let the prospect draw his own conclusions, when to use fear. Cites the 12 "most persuasive" selling words: you, money, save, new, results, health, easy, safety, love, discovery, proven, and guarantee.

"Five Steps To Faster Mailing," *Modern Office Procedures,* May, 1959.

Describes Ohio Machinery's (Cleveland) system for addressing 750,000 pieces a year to 30,000 addresses in 80 classifications. Punched cards, sorted geographically for reduced mail rates, are used to prepare a master address strip with a mirror image on the back. Mailing pieces are then addressed directly at the rate of 6,000 an hour on an addressing machine.

"A Small Company Billing Procedure," Virginia Gaffney, *NAA Bulletin,* March, 1959.

A small manufacturer required 6 typists and 1 comptometrist to prepare 500 invoices daily with 50 to 100 items on each. The system was improved by adding one part to the salesman's 4-part order form and having him enter prices and extensions. The extra copy was then attached to the invoice which simply read "items per attached order." The same volume of work is now handled by 2 typists instead of 7 clerical personnel.

"Material Control in an Electronic Production Control System," L. P. Guidi and P. J. Gutierrez, *NAA Bulletin,* May, 1959.

Provides a detailed account of the production control system of Lenkurt Electric (San Carlos, Calif.). Starts with release of parts by Engineering and preparation of material requisition cards by an IBM 650. Explains how costs are added and total costs prepared. Detailed flow charts are given of the entire system, including master parts lists and a "where-used" file.

"Wholesale House Cuts Order Processing Time 50%," *Office Executive,* March, 1959.

Describes a wholesale drug supplier's system for shipping 25,000 different items to 1,500 accounts. Prepunched item cards are used by a Univac to prepare detailed invoices with discounts and bonuses.

Publishers:

1. *American Business,* Dartnell Publications, Inc., 4660 Ravenswood Ave., Chicago 40.
2. *The Controller,* Journal of the Controllers Institute of America, 1 East 42nd St., New York 17.
3. *Industrial Management,* Industrial Management Society, Suite 1310, 330 So. Wells Street, Chicago 6.
4. *Management Methods,* Management Magazines, Inc., 141 E. 44th St., New York 17.
5. *Modern Office Procedures,* Irving B. Hexter, 812 Huron Road, Cleveland, Ohio.
6. *NAA Bulletin,* National Association of Accountants, 505 Park Avenue, New York 22.
7. *Office Executive,* Journal of the National Office Management Association, Willow Grove, Pa. **s/p/a**

Where To, Oh Systems Man?

► A recently published prediction in the *Harvard Business Review* is that by 1985, *Middle Management will be almost a thing of the past.* We will have only operating personnel and top management. Only a few "officials" will be left between these two extremes. And, there will be no such thing as moving from the operating to the management level. People will enter top management directly from universities or from top management positions in other companies. The Horatio Alger tradition will be but a wistful wraith.

It is predicted that the primary tools of these future top management men will be electronic data processing equipment and mathematical formulas.

Naturally, such conditions will not appear suddenly, as light does with the flick of an electric switch. How then does this prediction for twenty-five years hence affect us today? It means, I think, that we in systems work, who in many instances are laying the groundwork for EDP and OR, must take a long, hard look ahead, especially if we're young enough to expect to be rattling around in business twenty-five years from now. Are we getting ready for the future?

Anyone making a serious investigation for his own personal use must come to the conclusion that Systems techniques as applied today will be totally inadequate to achieve the results that will be demanded even a decade from now. And, if we Systems men today do not keep pace with the jet-speed changes, we will be displaced by others who can meet the need. These other people may carry different titles, but they will be doing *Systems* wook—an advanced type, however, which may make present systems scratchings look like a child's dawdlings.

America's business future is laden with golden opportunities. But the future belongs to those who prepare for it. As an organized group of Systems men, we are in a position to define our direction and educational needs for the near, intermediate, and distant future. We are in a position to develop the knowledge we need through our national organization, the Systems and Procedures Association. We are in a position to have that developed knowledge "spoon-fed" to us, if necessary, through our organization's educational facilities. If we fail to implement plans for the future, we may be overrun, discarded, by-passed, or forgotten by the increased flood of new events and techniques that are tumbling in upon Systems men today.

In view of the above, each SPA member should ask himself exactly *where* he plans to go in his management career, *why* he plans to go there, and *how* he plans to get there. It is entirely reasonable that in *partnership* with fellow SPA members, lies a key to preparation for 1985. (Richard W. Reynolds, Empire State Chapter, New York). **s/p/a**

THE INTERNATIONAL SYSTEMS MEETING

●

October 12-13-14, 1959
Royal York Hotel—Toronto

●

ONLY MAJOR CONFERENCE DEVOTED EXCLUSIVELY TO THE SYSTEMS FIELD

●

Sponsored for the 12th Consecutive Year by the SYSTEMS and PROCEDURES ASSOCIATION

●

A full program for all levels of systems and management. This year timely seminars form the heart of the program. A separate package in the form of a Systems Panorama is for registrants looking for an introduction to the systems function. Also, a separate package will be available for those who desire to be updated on advance systems concepts.

●

Mail Address:

For further information write, wire, or call:

George K. MacDonell,
General Chairman, 1959 I.S.M.,
Bank of Nova Scotia,
44 King Street, West
Toronto, Ontario, Canada

Systems & Procedures Association
4463 Penobscot Bldg., Detroit 26, Mich.

Return Postage Guaranteed

CHAPTERS

ADIRONDACK
AKRON-CANTON
BALTIMORE
BAY STATE
BOSTON
CAPITAL DISTRICT
CARACAS
CENTRAL OHIO
CENTRAL NEW YORK
CENTRAL PENNSYLVANIA
CHICAGO
CINCINNATI
CLEVELAND
CONNECTICUT
DALLAS
DELAWARE VALLEY
DETROIT
EMPIRE STATE
GARDEN STATE
GOLDEN TRIANGLE
HAMILTON
HEART OF AMERICA
HOUSTON
JOLIET
KEYSTONE
KNICKERBOCKER
LONG BEACH
LONG ISLAND
LOS ANGELES
MANHATTAN
MILE - HI
MILWAUKEE
MONTREAL
MOTOR CITY
NEW HAMPSHIRE
NEW ORLEANS
NEW YORK
NORTHERN NEW JERSEY
OKLAHOMA CITY
ORANGE BELT
PACIFIC NORTHWEST
PALISADES-INTERSTATE
PHILADELPHIA
PHOENIX
PITTSBURGH
RICHMOND
ST. LOUIS
SAN DIEGO
SAN FERNANDO VALLEY
SAN FRANCISCO
SANTA CLARA VALLEY
SOUTHERN CALIFORNIA
TOLEDO
TORONTO
TULSA
TWIN CITIES
UPPER MOHAWK
VANCOUVER
WASHINGTON
WESTERN MICHIGAN
WINDY CITY